



Northern San Joaquin Valley  
Water Reclamation Project

**Volume I**  
**Feasibility Study Report**  
**Final Draft**

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**RMC**  
Water and Environment



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## ABBREVIATIONS

Abbreviation	Definition
ACOE	Army Corp of Engineers
ADWF	Average Dry Weather Flow
AF	Acre-foot (feet)
AFY	Acre-feet per year
BOD	Biochemical Oxygen Demand
B&V	Black and Veatch
CCI	Construction Cost Index
CEQA	California Environmental Quality Act
cfs	Cubic feet per second
CCR	California Code of Regulations
CPD's	Comprehensive Planning Districts
CTR	California Toxics Rule
CVP	Central Valley Project
DAF	Dissolved Air Flotation
DFG	(California) Department of Fish and Game
DHS	(California) Department of Health Services
DMC	Delta Mendota Canal
DO	Dissolved Oxygen
DWR	(California) Department of Water Resources
EC	Electrical Conductivity
EDW	Effluent Dominated Waterway
EID	Eastside Irrigation District
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ft	Foot (feet)
gpm	Gallons per minute
GW	Groundwater
kg/day	kilograms per day
MBR	Membrane Bioreactor
MF	Microfiltration
mg/L	milligrams per liter
MG	Million gallons
MGD	Millions of gallons per day
M & I	Municipal and Industrial
MID	Modesto Irrigation District
mmhos/cm	milliohms per centimeter
MOU	Memorandum of Understanding
MPN	Most Probable Number (bacteriological quality)

<b>Abbreviation</b>	<b>Definition</b>
MWD	Metropolitan Water District
N/A	Not Applicable
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
O&M	Operation and Maintenance
Project	Northern San Joaquin Valley Regional Recycled Water Project
psi	Pounds per square inch
RMC	Raines, Melton and Carella, Inc.
RO	Reverse Osmosis
RWF	Recycled Water Facility
RWQCB	(Central Coast) Regional Water Quality Control Board
SAR	Sodium Adsorption Ratio
SBCWD	San Benito County Water District
SBR	Sequencing Batch Reactor
SCVWD	Santa Clara Valley Water District
SIP	State's Implementation Plan
SJRNWR	San Joaquin River National Wildlife Refuge
SWRCB	(California) State Water Resources Control Board
TDS	Total Dissolved Solids
TID	Turlock Irrigation District
TM	Technical Memorandum
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TSS	Total Suspended Solids
UC	University of California
USBR	United States Bureau of Reclamation
USFWS	United States Fish and Wildlife Service
UV	Ultraviolet
WDR	Waste Discharge Requirement
WSID	West Stanislaus Irrigation District
WWD	Westlands Water District
WWTF	Wastewater Treatment Facility
WWTP	Wastewater Treatment Plant

## **Executive Summary**

This Executive Summary provides an overview of the feasibility study and highlights the key findings and conclusions that are further detailed in this report. The Northern San Joaquin Valley Water Reclamation Project includes assessment of the recycled water markets, review of regulatory requirements, development and evaluation of alternatives for regional water recycling and wastewater treatment, selection of a recommended alternative(s), and development of an implementation plan.

***The drivers for a recycled water project can be linked to benefits related to wastewater treatment and disposal, water supply and quality, and environmental protection and enhancement.***

These key drivers were used to develop goals and objectives for the Project through workshops with the City of Modesto and the Project team. The goals and objectives were:

- To meet the City's wastewater treatment and disposal needs. (Water Quality)
- To reduce the impact of wastewater discharge on the San Joaquin River while considering environmental benefits.
- To help meet the City's water supply needs.
- To meet, where feasible, the Northern San Joaquin Valley regional water supply and wastewater treatment and disposal needs.
- Identify, and rank projects based on criteria, including political feasibility, environmental feasibility, and cost effectiveness.
- Identify a recommended alternative or alternatives for further evaluation.

***Future growth in the Northern San Joaquin Region will increase water use and require wastewater treatment and disposal upgrades.***

In 2002, the City of Modesto's average total daily production of drinking water was approximately 73.3 million gallons per day (mgd) for the entire service area, with an annual production total of 82,100 acre-feet (AF) (West Yost & Associates, March 2003). Water production to meet future projected demands is expected to increase to approximately 122,200 AFY at the current general plan build-out level (West Yost & Associates, March 2003).

Groundwater and surface water are the major sources of drinking water supply for the City of Modesto. The sustainable yield of the groundwater basin is estimated to be approximately 50,000 AFY. The surface water supply for the City's water system is provided by the Modesto Irrigation District (MID) from the Tuolumne River. The MID Water Treatment Plant provides an average daily flow capacity of 30 mgd. A 30-mgd expansion of the MID surface water treatment plant is in the process of being implemented to help meet future needs.

Table ES-1 summarizes wastewater flows to the City of Modesto WWTP's. Disposal of treated wastewater is achieved through evaporation, percolation ponds, ranch irrigation, and discharge to the San Joaquin River (seasonal).

**Table ES-1: Modesto Primary and Secondary Wastewater Treatment Plant Flows-Yrs 2000-2002**

Process Component	Average Flow (mgd) <sup>a</sup>	Season
Primary Influent	24.5	Year Round
Segregated Cannery Waste to Ranch	16.4	July-Sept
Secondary WW Irrigation to Ranch	13.0	Year Round; varies with weather, soil conditions.
Secondary WW Discharge to San Joaquin River	25.5	Nov (or Dec)-May; varies with available water quality, and river flows. NPDES permitted discharge Oct 1-May 31.

Footnotes:

- a. Reported monthly average flow is based on data provided by City of Modesto for period from January 2000 to December 2002.

Under current conditions, during a dry year, Modesto is expected to have a disposal capacity shortfall of approximately 500 million gallons. The City is in the process of implementing a Dissolved Air Floatation (DAF) project which will reduce total suspended solids (TSS) concentrations of the wastewater effluent allowing for increased disposal capacity to the San Joaquin River in the fall. This is expected to meet current capacity needs but does not provide for future projected increases in wastewater flow.

In addition to treatment and disposal capacity upgrades, more advanced wastewater treatment may be required in the future. Discharge requirements continue to become more stringent as the State continues to investigate and regulate more contaminants. Discharge requirements are expected to become more stringent due to 1) tightening of Water Quality Control Plan (Basin Plan) water quality objectives by the RWQCB (eg, for salinity), 2) the implementation of the California Toxics Rule (CTR) through the State's Implementation Plan (SIP), and 3) total maximum daily load (TMDL) requirements for surface waters.

***The City of Modesto conducted two stakeholder workshops to identify interested parties and collect information and comments on the Project.***

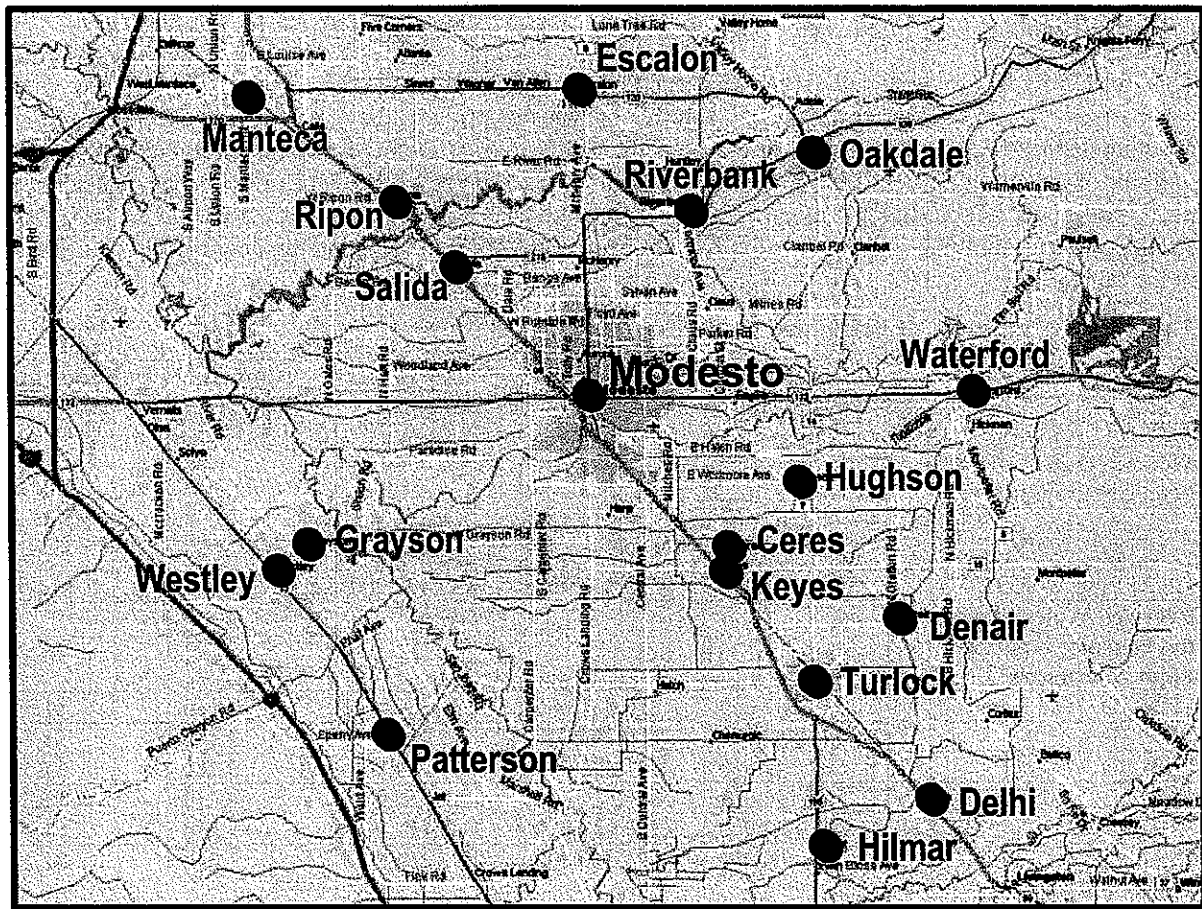
A number of the cities surrounding Modesto (see Figure ES-1) provide municipal wastewater services in their service areas. These cities, plus local irrigation districts in the region, and other agencies such as Stanislaus County government, were identified as potential stakeholders for the project and were invited to two stakeholder workshops.

The first workshop was an informative workshop to introduce the Project, collect information, obtain feedback, and identify stakeholders interested in participation. A second workshop was held to present and discuss preliminary wastewater regionalization and recycling concepts with stakeholders and to collect comments on the conceptual alternatives.

***The use of recycled water for urban use (in the Modesto service area) and water sale opportunities are the markets thought to be the most feasible.***

An assessment of urban, agricultural, water sale, environmental, and groundwater recharge opportunities led to the selection of urban use and water sale opportunities as the most promising recycled water markets. The potential urban market includes landscape irrigation, industrial reuse, and other non-potable uses. The potential market users include parks, golf courses, schools, the top 50 industrial water users, and dual plumbing of new developments.

**Figure ES-1: City of Modesto and Other Cities**



There are a number of agencies that are interested in the region's potential recycled water supply for agricultural use. The use of recycled water for local agricultural irrigation (in either MID or Turlock Irrigation District (TID) service areas) is limited due to a number of issues, the primary issue being the availability, reliability and low cost of raw surface water and/or groundwater currently available to water users in both MID and TID service areas.

Beyond irrigation, the San Joaquin River National Wildlife Refuge (SJRNWR) is a potentially significant opportunity for wetlands enhancement. Groundwater recharge projects do not appear feasible at this time due to treatment requirements and associated project costs.

Based on the intended use of the recycled water, meeting Title 22 Disinfected Tertiary Recycled Water regulation would be required for agricultural use or urban use. Title 22 Disinfected Tertiary Recycled Water is filtered and disinfected. The precise requirements for SJRNWR are unknown at this time, but cost estimates for the implementation of recycled water development were prepared based upon the expected requirements.

***Urban use and Water Sale Alternatives appear to be the most feasible opportunities.***

This feasibility study included development and assessment of four conceptual-level recycled water alternatives. These alternatives are representative of types of projects that could be implemented and are not intended to meet all the goals and future needs. This set of alternatives of four alternative make up a toolbox of options that could be combined to form an overall recycled water project that meets future needs and goals. Table ES-2 summarizes the estimated costs of the alternatives. It should be noted that federal and state funding is available and has not been considered in reducing the net project costs shown in the table.

**Table ES-2: Summary of Estimated Costs**

Project Alternative	Total Construction Cost	Total Capital Cost	Total Annualized Cost	Annual Yield (AFY)	Unit Cost (per AFY)
<b>Modesto Only/No RW Project Alternative<sup>a</sup></b>					
Existing Flow, 25.5 MGD	\$4,500,000	\$5,850,000	\$925,000		\$500 <sup>b</sup>
2025 Flow w/o RO	\$75,900,000	\$98,670,000	\$8,600,000		\$240 <sup>b</sup>
2025 Flow w/ RO	\$286,163,000	\$372,012,000	\$39,402,000		\$1,090 <sup>b</sup>
<b>Recycled Water Plant at the Primary Treatment Plant Alternative</b>					
2 MGD	\$12,137,000	\$15,801,000	\$1,769,000	1,140	\$1,550
4 MGD	\$22,550,000	\$29,343,000	\$3,310,000	2,100	\$1,580
6 MGD	\$32,147,000	\$41,827,000	\$4,764,000	3,180	\$1,500
8 MGD	\$42,134,000	\$54,814,000	\$6,256,000	4,250	\$1,470
10 MGD	\$51,834,000	\$67,433,000	\$7,722,000	5,360	\$1,440
<b>Ripon and Salida Satellite Treatment Plant Alternative, 2 MGD</b>	\$18,464,000	\$24,018,000	\$2,354,000	1,060	\$2,220
<b>Water Sale Alternative, 37 MGD</b>	\$103,493,000	\$134,589,000	\$14,469,000	20,000	\$720
<b>Beard Satellite Treatment Plant Alternative</b>					
5 MGD	\$48,099,000	\$62,529,000	\$6,604,000	1,380	\$4,790
10 MGD w/o RO	\$47,730,000	\$62,080,000	\$6,049,000	2,760	\$2,190
10 MGD w/ RO	\$104,220,000	\$135,517,000	\$13,994,000	2,760	\$5,070

Notes:

1. Annualized costs are based on a 30-year recovery period at 6% interest.
2. A construction contingency of 50% and engineering, legal, administrative, and environmental contingency of 30% were applied to the construction cost estimates. These high cost multipliers were appropriate due to the preliminary nature of this feasibility study. Environmental constraints, retrofit needs, geotechnical considerations, and other factors have not been evaluated or taken into consideration.
3. Additional work is necessary to refine project elements and costs.

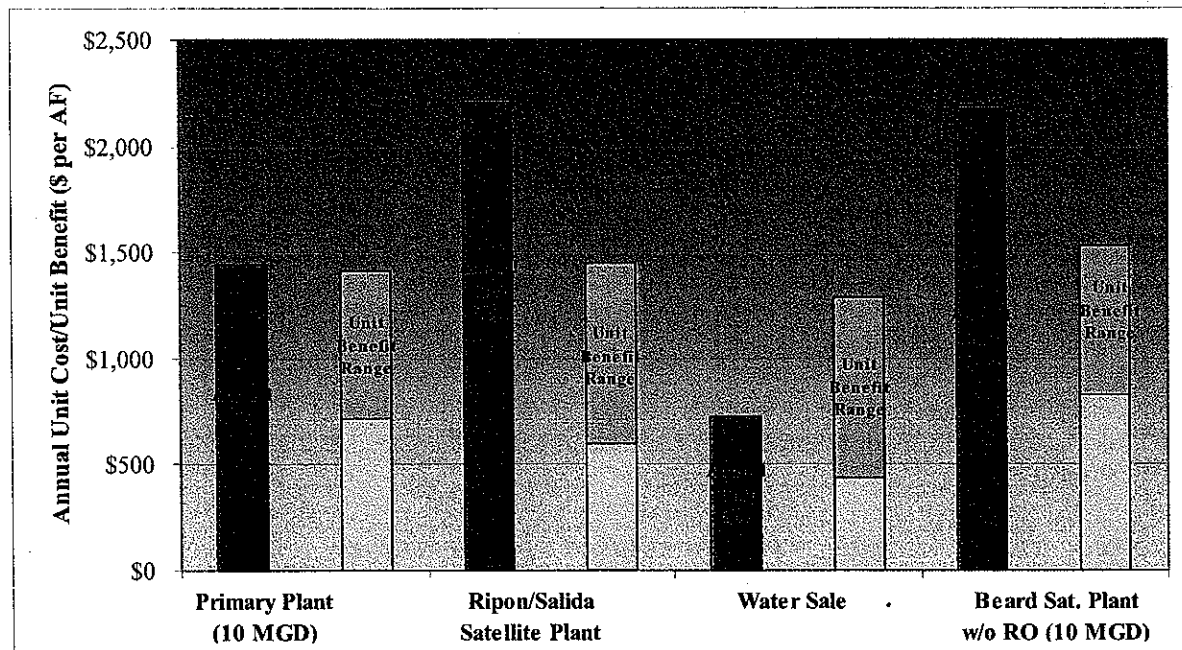
Footnotes:

- a. The estimated unit cost of the No RW Alternative should not be directly compared to the recycled water alternatives as other benefits need to be considered. The unit costs are used as a basis for the avoided cost of disposal benefit associated with each recycled water alternative.
- b. Existing flow unit disposal capacity cost was calculated assuming an increase capacity of 1,800 AFY. The 2025 unit disposal capacity cost was calculated assuming an increase of 30.5 mgd (34,200 AFY) plus the 1,800 AFY associated with the DAF facilities.

The benefits of each alternative were then assessed and compared to estimated alternative costs to assess the feasibility of the project alternatives and to develop conclusions. Figure ES-2 shows a comparison of the annual costs and estimated benefits of each of the alternatives. Given the conceptual nature of this

evaluation, only preliminary conclusions could be drawn regarding a recommended recycled water alternative.

**Figure ES-2: Estimated Annual Costs and Associated Benefits**



**Notes:**

1. The benefit range is associated with the varying levels of treatment required for future wastewater disposal.
2. Unit benefit values are summarized in Section 5.8.
3. Potential benefits are related to water supply, wastewater disposal, avoided cost of water supply capacity, avoided cost of wastewater disposal capacity, supply reliability, environmental enhancement, and regionalization. Other factors such as ease of implementation, public acceptance, and political feasibility should also be considered.

Benefit values of the urban and water sale alternatives may exceed project costs providing a net benefit. The Ripon/Salida Satellite Treatment Plant Alternative and Beard Satellite Plant Alternative do not appear to be practical at this preliminary level of analysis. However, due to the very conceptual nature of this feasibility study, it is recommended that these alternatives not be eliminated from future consideration. The following paragraphs provide additional discussion of the alternatives.

The water sale alternative is the most cost effective recycled water project. The project would result in beneficial use of recycled water which is a reliable supply. Environmental benefits will be realized as diversions of San Joaquin River water are reduced. Wastewater disposal capacity would be increased with the use of recycled water. This project would require an agreement with an irrigation district for use of the water. From an implementation perspective, this project is expected to require significant work and negotiation with an irrigation district. In conjunction with this project, recycled water may also be used in the SJRNWR which would use the supply for wetlands enhancement.

A recycled water project at the primary treatment plant would primarily serve urban customers. This would have water supply and wastewater benefits. The quantity of recycled water produced would be significantly less than the envisioned water sale alternative. However, this project would be a good project to demonstrate the beneficial use of recycled water and build support for a more extensive recycled water project beyond the City boundary.

The Ripon and Salida Satellite Treatment Plant Alternative is a representative example of the type of project that could be implemented by a group of stakeholders. The concept would provide recycled water to the City of Modesto Comprehensive Planning Districts (CPDs) and is therefore contingent on these future developments. Markets for other groups of stakeholders have not been identified. This alternative would result in water use and wastewater disposal benefits. Unit costs for this alternative are relatively high as primary, secondary, and disposal upgrades would be required, in addition to tertiary and disinfection processes.

The Beard Satellite Treatment Plant Alternative has the highest unit cost of the recycled water alternative as currently defined. The high cost is related to the assumed need for reverse osmosis (RO) treatment to meet industrial water quality requirements for low salinity water. As discussed in Section 5.7, the Beard Satellite Treatment Plant Alternative is envisioned to be a joint project with a cogeneration facility. The cogeneration facility is only a conceptual idea that has yet to formally be investigated. Although this alternative has a high unit cost, it is recommended that the City evaluate the alternative if the City moves forward with a cogeneration investigation.

Considering the number of unknowns and issues that need to be investigated for each of the alternatives, the Project Team and City of Modesto staff have identified a recommended strategy for continuing work on the Project.

***The recommended strategy (a four-phased approach) for a recycled water project is to pursue the most promising alternatives that were developed.***

A four-phased approach was developed to pursue recycled water opportunities ranging from urban uses in Modesto to regional water recycling over broad geographies with the hope that the optimal projects will result. The four phased approach includes:

- Phase 1 - Urban Recycled Water served by the City of Modesto Primary Treatment Plant (Near-term)
- Phase 2 - Regionalization Treatment and Recycling Alternatives (Near-term to Mid-term)
  - Patterson conveyance system to the existing Secondary Treatment Facility
  - Construction of the Ripon, Salida, and Riverbank Satellite Treatment Plant
- Phase 3- Water Sale Alternative with an Irrigation District and/or SJRNWR (Mid-term)
- Phase 4 - Regional Recycled Water Facility Serving other Agencies/Districts (Long-term)
  - Westlands Water District
  - South San Joaquin Valley

The timeframes for implementation include a near-term (next 5 years), mid-term (5 to 8 years), and long-term (8+ years) strategy for the development of recycled water for the City of Modesto and its interested stakeholders. Figures ES-3 to ES-5 are schematic diagrams of Phases 1 through 3. Figure ES-3 shows the proposed Phase 1 project with recycled water facilities at the existing primary treatment plant and service to the urban service area.

**Figure ES-3: Schematic of the Recycled Water Served by the Modesto Primary Treatment Plant**

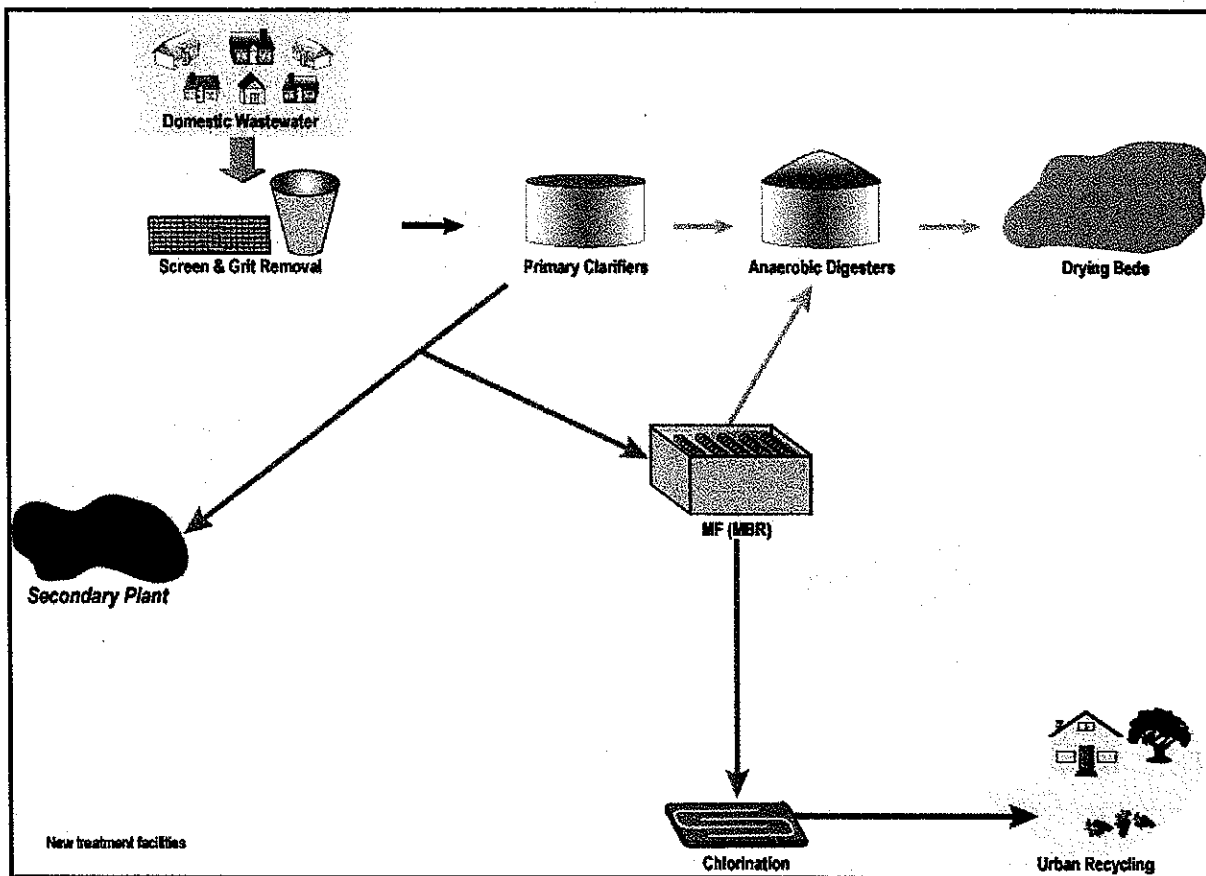


Figure ES-4 shows the proposed Phase 2 project with a Satellite Treatment Plant that would serve recycled water to urban customers in the City of Modesto service area. It is envisioned that recycled water would serve new developments also known as Comprehensive Planning Districts (CPDs).

**Figure ES-4: Schematic of the Ripon and Salida Satellite Treatment Option**

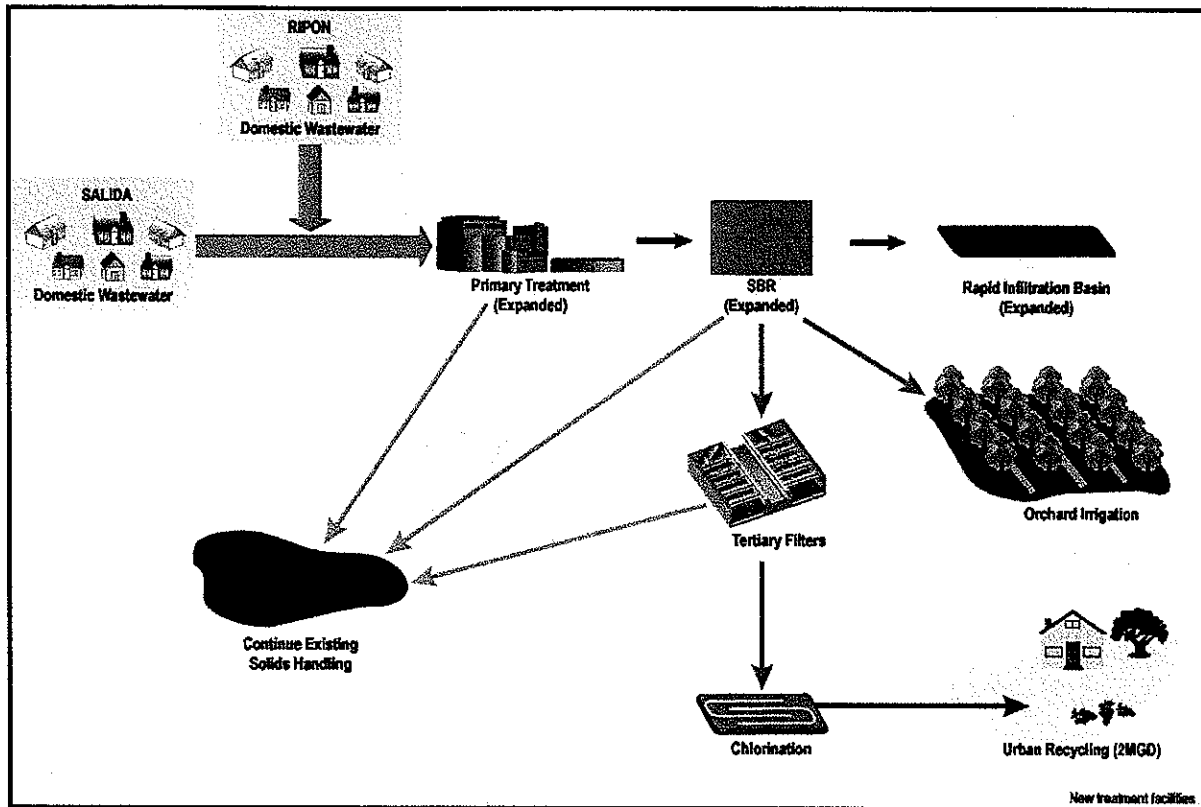
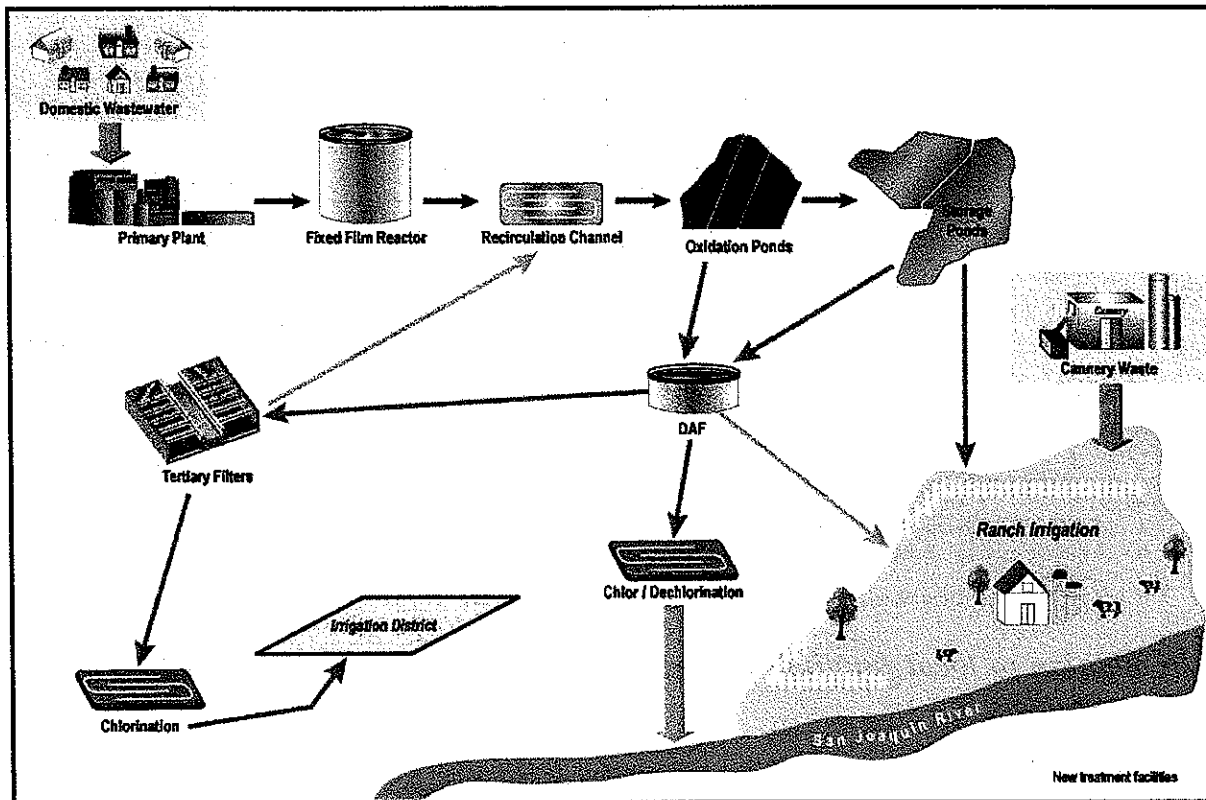


Figure ES-5 shows the proposed water sale alternative to an irrigation district. This project would entail construction of recycled water facilities at the existing secondary treatment plant and sale of recycled water to an irrigation districts. Conceptually, it is thought that recycled water would offset river diversions that are expected to be an environmental benefit to the Sacramento/San Joaquin Delta.

The Phase 4 project is similar to Phase 3 and would expand recycled water use through additional recycled water sale to other irrigation districts.

**Figure ES-5: Schematic of Water Sale**



***The estimated unit cost of the Phase 1-3 Projects combined is \$930 per AF.***

The concept level estimated costs of the Phase 1-3 projects are presented in Table ES-3. The cost of the Phase 4 project has not been developed as details and costs of the alternative cannot be precisely estimated at this time and will vary significantly, depending on the interests of the future stakeholders. Estimated costs are in Summer 2003 dollars.

**Table ES-3: Estimated Cost Summary of Phase 1, 2, and 3 Project Approaches**

Project Element	Estimated Cost			
	Phase 1 <sup>a</sup>	Phase 2 <sup>b</sup>	Phase 3 <sup>c</sup>	Total
<b>Raw Construction Costs</b>	<b>\$34,556,000</b>	<b>\$12,309,000</b>	<b>\$68,995,000</b>	<b>\$115,860,000</b>
Construction Contingency (50%)	\$17,278,000	\$6,155,000	\$34,498,000	\$57,931,000
<b>Total Construction Cost</b>	<b>\$51,834,000</b>	<b>\$18,464,000</b>	<b>\$103,493,000</b>	<b>\$173,791,000</b>
Right of Way	\$49,000	\$15,000	\$48,000	\$112,000
Engr, Legal, Admin, and Environ. (30%)	\$15,550,000	\$5,539,000	\$31,048,000	\$52,137,000
<b>Total Capital Cost</b>	<b>\$67,433,000</b>	<b>\$24,018,000</b>	<b>\$134,589,000</b>	<b>\$226,040,000</b>
Annualized Capital	\$4,899,000	\$1,745,000	\$9,778,000	\$16,422,000
Combined Annual O&M	\$2,823,000	\$609,000	\$4,691,000	\$8,123,000
<b>Total Annualized Cost</b>	<b>\$7,722,000</b>	<b>\$2,354,000</b>	<b>\$14,469,000</b>	<b>\$24,545,000</b>
Annual Yield (AFY)	5,360	1,060	20,000	26,420
<b>Unit Cost</b>	<b>\$1,440</b>	<b>\$2,220</b>	<b>\$720</b>	<b>\$930</b>

Notes:

1. Annualized costs are based on a 30-year recovery period at 6% interest.

Footnotes:

- a. Estimated cost for the 10 MGD Urban Use Alternative at the Primary Treatment Plant.
- b. Estimated cost for the Ripon and Salida Satellite Treatment Plant Alternative. Does not include costs associated with Escalon joining the project.
- c. Estimated cost for the Water Sale Alternative to a near by irrigation district.

***In addition to local funding, Federal and State funding is available for recycled water projects.***

Projects can be funded on the local level through municipal debt (bonds or certificates of participation) that can be repaid through utility rates (increases in water or sewer rates), impact fees, or special assessments. The regional and/or water sale aspects of the water recycling projects would also provide an opportunity for a joint project. This may result in a cost sharing opportunity for the City, with one or more stakeholders, or with a water importer.

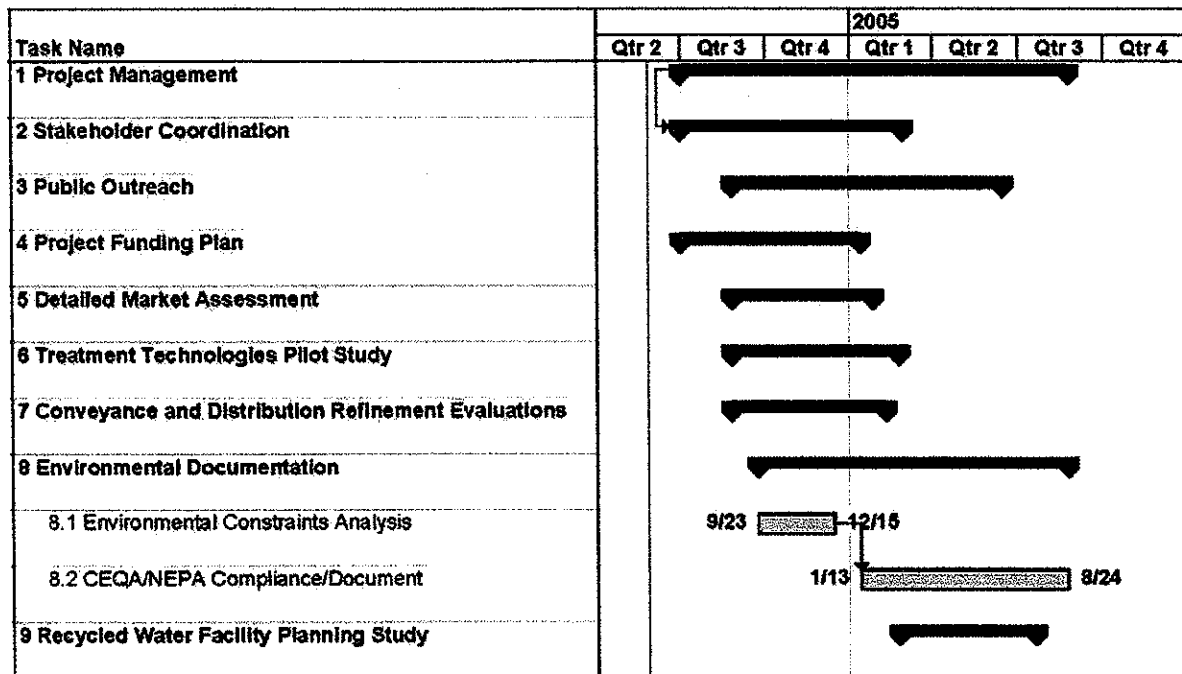
Funding for projects may also be available from Federal and/or State agencies. State and Federal grants and loans from the State Water Resources Control Board (SWRCB), California Department of Water Resources (DWR), and the U.S. Bureau of Reclamation (USBR) may apply to these project phases. Grant funding would reduce the amount of local funding needed for the project, reducing its unit cost, and improving the project's financial feasibility.

***The recommended implementation approach is to complete a facilities planning phase followed by design and construction, as feasibility dictates.***

Additional planning-level work is needed to further refine the alternatives recommended as part of the phased approach. The next steps should include stakeholder coordination, funding strategy development, detailed market analysis, public outreach planning, additional engineering evaluation, and environmental compliance.

Figure ES-6 shows the implementation schedule for the next phase of planning work. Design and construction phases are not shown in the schedule but are expected to follow the completion of the Environmental Document and the Facility Plan Report.

**Figure ES-6: Implementation Schedule for Facility Planning and Project Refinement**





## 1 Introduction

Recycled water projects have continued to be implemented throughout California to augment water supply as the cost of additional freshwater supplies continues to increase. High quality water is a valuable resource that continues to be in short supply throughout California. A number of agencies throughout the state are in short supply and are evaluating alternatives to meet future demand.

Additionally, the continued increase in the regulatory requirements associated with wastewater treatment and disposal in the northern San Joaquin Valley has resulted in many cities and agencies reevaluating their wastewater treatment and disposal options. The concept of increased regionalization of wastewater treatment and disposal is appropriate to determine the most cost-effective strategy for meeting future regulatory requirements.

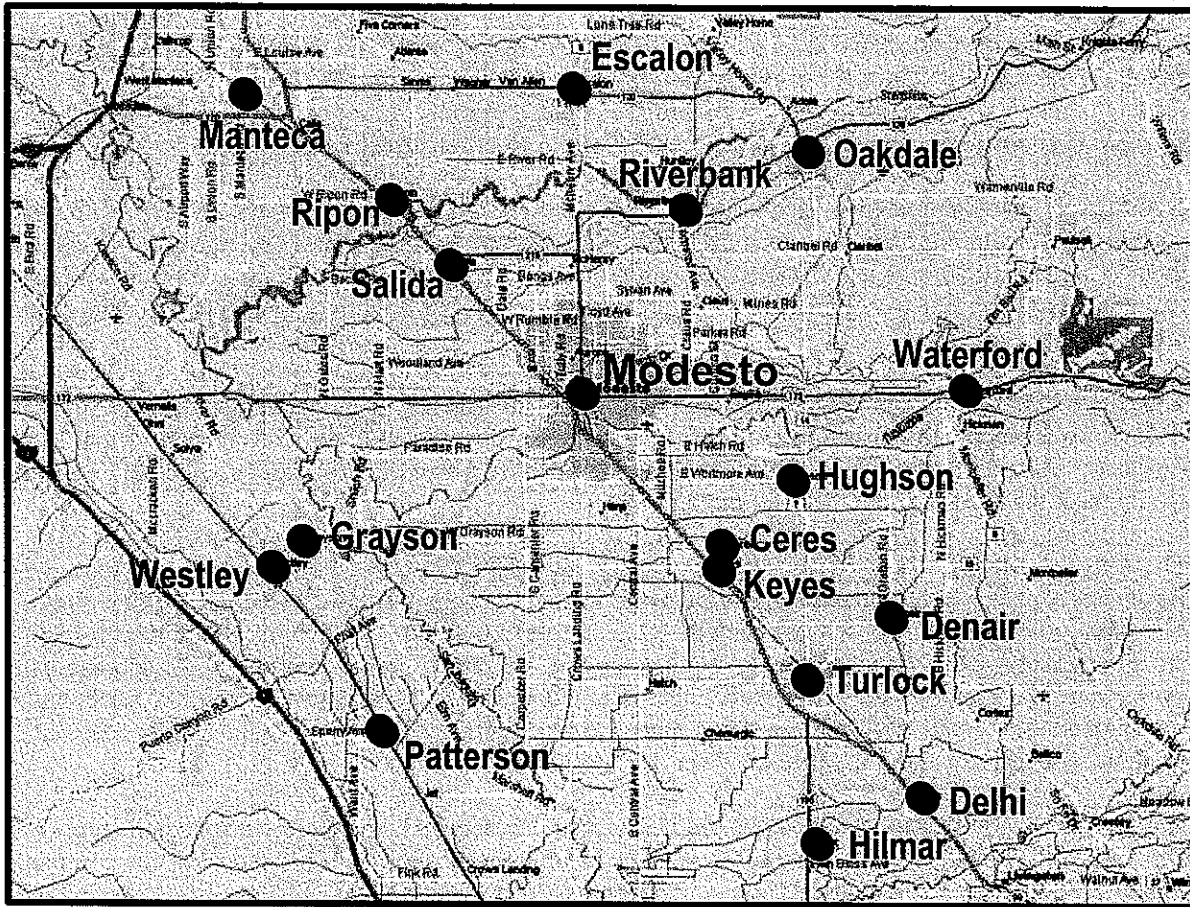
The City of Modesto retained Raines, Melton, & Carella, Inc. (RMC), in association with Black & Veatch (B&V), to evaluate the feasibility of the Northern San Joaquin Valley Water Reclamation Project (Project). The purpose of the feasibility study was to identify a cost effective water recycling project that would meet the needs of both the City and the region.

The City of Modesto applied for and secured grant funding for the Project from the State Water Resources Control Board (SWRCB) through the Water Recycling Facilities Planning Grant Program. The grant provides a 50% cost share with the City up to \$75,000. This Feasibility Study Report includes an assessment of the recycled water market, review of regulatory requirements, development and evaluation of alternatives for water recycling and regionalization of wastewater treatment, selection of a recommended alternative(s), and an assessment of the feasibility of implementation of a regionalized wastewater treatment and/or a recycled water project.

Half of the \$75,000 grant (\$37,500) would be dispersed to the City upon substantial completion of the Draft Feasibility Study Report. The City would be eligible for the other half of the grant upon completion of related environmental documents and obtaining market assurances, which are not part of this Study.

The City of Modesto is located in Stanislaus County in the heart of the Central Valley and is home to approximately 190,000 people. Located near Highway 99, the City is surrounded by various agricultural irrigation districts and supports cannery and other agricultural processing activities. The City is also surrounded by a number of smaller cities and communities as shown in Figure 1-1.

Figure 1-1: City of Modesto and Other Cities



A number of the cities surrounding Modesto provide municipal services in their service areas. These cities plus local irrigation districts in the region and other agencies such as Stanislaus County government were identified as potential stakeholders for the project. Table 1-1 lists the potential stakeholders for the project, specifically cities and communities.

**Table 1-1: Potential Stakeholders (Cities, Irrigation Districts, and Other Agencies)**

Cities	Irrigation Districts and Other Stakeholders
City of Modesto	Stanislaus County
City of Manteca	San Joaquin River National Wildlife Refuge
City of Ripon	Modesto Irrigation District
City of Salida	Turlock Irrigation District
City of Escalon	West Stanislaus Irrigation District
City of Riverbank	Eastside Irrigation District
City of Oakdale	Westlands Irrigation District
City of Waterford	
City of Hughson	
City of Ceres	
City of Keyes	
City of Denair	
City of Turlock	
City of Patterson	
City of Hilmar	
City of Delhi	
City of Grayson	

The City of Modesto conducted two stakeholder workshops to collect information and comments on the Project. The first workshop was an informative workshop to introduce the Project, collect information, obtain feedback, and identify stakeholders interested in participation. A second workshop was held to present and discuss preliminary concepts with stakeholders and to collect comments on the conceptual alternatives.

## **1.1 Project Goals and Objectives**

Drivers for recycled water projects can be linked to benefits related to wastewater treatment and disposal, water supply and quality, and environmental protection and benefit. These key drivers were used to develop goals and objectives for the Project through workshops with the City of Modesto and the Project team. The goals and objectives were:

- To meet the City's wastewater treatment and disposal needs. (Water Quality)
- To reduce the impact of wastewater discharge to the San Joaquin River while considering environmental benefits.
- To help meet the City's water supply needs.
- To meet, where feasible, the Northern San Joaquin Valley regional water supply and wastewater treatment and disposal needs.
- Identify, and rank projects based on criteria, including political feasibility, environmental feasibility, and cost effectiveness.
- Identify a recommended alternative or alternatives for further evaluation.

## **1.2 Feasibility Study Organization**

This feasibility study report consists of two volumes. Volume I of the Feasibility Study contains the Feasibility Study Report. It is organized into the sections below. A list of references utilized for the compilation of this Feasibility Study is provided at the end of Volume I.

- **Section 1 – Introduction** (this section)

- **Section 2 – Study Area Characteristics.** This section identifies the current conditions in the Northern San Joaquin Valley region including hydrologic features, water usage, water quality, land use, future projections and the water supply picture. Section 2 also reviews the existing wastewater treatment facilities (WWTF's) in the region, including effluent flows, water quality, seasonal issues and discharge requirements.
- **Section 3 – Market Assessment.** This section identifies potential users of recycled water, including urban, agricultural, water sale, environmental, and groundwater recharge uses. Water quantity and quality requirements, design requirements, unique issues, and implementation hurdles are identified for each type of use.
- **Section 4 – Alternative Development and Assessment.** This section identifies the conceptual alternatives that were developed and assesses the feasibility of each alternative. Conceptual level cost estimates were developed and benefits were identified for each alternative.
- **Section 5 – Recommended Strategy.** This section identifies a recommended four phased strategy for near-term and long-term recycled water use in the region. At this stage in the evaluation, it was determined that the recommended strategy should include continued pursuit of several alternatives. Costs for the overall project are identified, as well as the impacts and legal and/or institutional issues associated with the proposed project.
- **Section 6 – Next Steps.** This section identifies the recommended next steps for the project including an implementation strategy and schedule.

Volume II of the Feasibility Study contains five appendices. The appendices are as follows:

- **Appendix A – Goals and Objectives Workshop Technical Memorandum (TM).** This TM details the preliminary data and information that was collected for the goals and objectives workshop. The TM also summarizes the goals that were developed by the project team and the City of Modesto. Meeting minutes from the first stakeholder workshop are also included.
- **Appendix B – Market Assessment TM.** This TM identifies the markets that were investigated during the initial phases of work. Urban, agricultural, water sale, environmental, and groundwater recharge opportunities were investigated. The TM provided the basis for refinement during the alternative development phase of the Feasibility Study.
- **Appendix C – Regulatory Assessment TM.** This document provides an analysis of the regulatory setting in the region related to wastewater treatment and disposal requirements. Title 22 treatment requirements for recycled water use are also summarized.
- **Appendix D – Water and Wastewater Needs TM.** This document focuses on the City of Modesto's existing and future wastewater and water needs. The document primarily summarizes data from other reports and sources.
- **Appendix E – Identify and Develop Alternatives TM.** This TM identifies the conceptual alternatives that were developed for the Project. Cost estimates were developed and detailed for each of the conceptual alternatives. The TM details the facility and cost assumptions used for each alternative.

## **2 Study Area Characteristics**

This section identifies the setting of the Northern San Joaquin Valley Water Reclamation Project including hydrology, land use, and water sources. This section also describes the wastewater treatment facilities in the region that are potential sources of recycled water.

This section is organized as follows:

- Basin Setting
- Water Needs
- Wastewater Needs

### **2.1 Basin Setting**

The Northern San Joaquin Valley region (generally Stanislaus County) is located in the heart of the agriculturally rich central valley with the Sierra Nevada mountain range to the east and the Diablo mountain range to the west. Agriculture is the primary basis of the economic prosperity in the region. Stanislaus County is home to a population of approximately 450,000 (2000 Census data). Over the next 20 years the population in the County is expected to double.

#### **2.1.1 Climate**

The major features of the area's climate are hot, dry summers and cool, wet winters. Most of the precipitation occurs from November to March with little to no precipitation occurring during the summer months from June to September. The average annual rainfall is 12 inches. The lowest rainfall year of record was in 1913, registering 4.30 inches, while the highest recorded rainfall was 26.01 inches in 1983. Summer temperatures commonly are above 85 degrees F and may exceed 100 degrees F, but rarely in excess of 105 degrees F. Winter temperatures commonly fall below 32 degrees F, but they are rarely lower than 25 degrees F (B&V, 2000).

#### **2.1.2 Hydrology**

The major surface waters in the region include the San Joaquin River, Stanislaus River, Tuolumne River, Dry Creek, and Merced River. The Tuolumne River is a major water source for the region as it provides supply for agricultural, municipal, and industrial uses. The Tuolumne River originates to the east in the Sierra Nevada mountain range and flows into Don Pedro Reservoir. Spring snow melt for the 1,880 square mile Tuolumne River watershed provides runoff into Don Pedro Reservoir for use during the irrigation season (B&V, 2000).

The Tuolumne River supply was developed near the turn of the 20<sup>th</sup> century by the Modesto Irrigation District (MID) and Turlock Irrigation District (TID). These two private irrigation districts constructed the La Grande Dam, Modesto Reservoir, and Don Pedro Reservoir to store water and facilitate beneficial use. The Districts have also constructed conveyance canals, control structures, pipelines, and pump stations throughout their service area to deliver water to agricultural lands. MID also delivers water to the City of Modesto for municipal and industrial uses.

The San Joaquin River is tributary to the Sacramento/San Joaquin Delta and is the major drainage pathway for the San Joaquin Valley. Tributary flows to the San Joaquin River originate in the Sierra Nevada mountain range. Major tributary rivers include the Stanislaus River, Tuolumne River, Merced

River, Chowchilla River, and Fresno River. These surface waters are used beneficially for agriculture, municipal, and industrial use.

The San Joaquin River watershed does have water quality issues associated with agricultural drainage and runoff. Salinity, selenium, boron, organophosphate pesticides and toxicity are concerns in the watershed (DWR, August 2003)

### **2.1.3 Groundwater Basin**

The Northern San Joaquin Valley region sits atop a portion of the San Joaquin Valley groundwater basin. The City of Modesto and other local stakeholders are generally located above the Modesto, Tuolumne/Stanslaus, Turlock, and northern portion of the Delta-Mendota subbasins. Groundwater in the region is also pumped by other Cities, purveyors, or private parties.

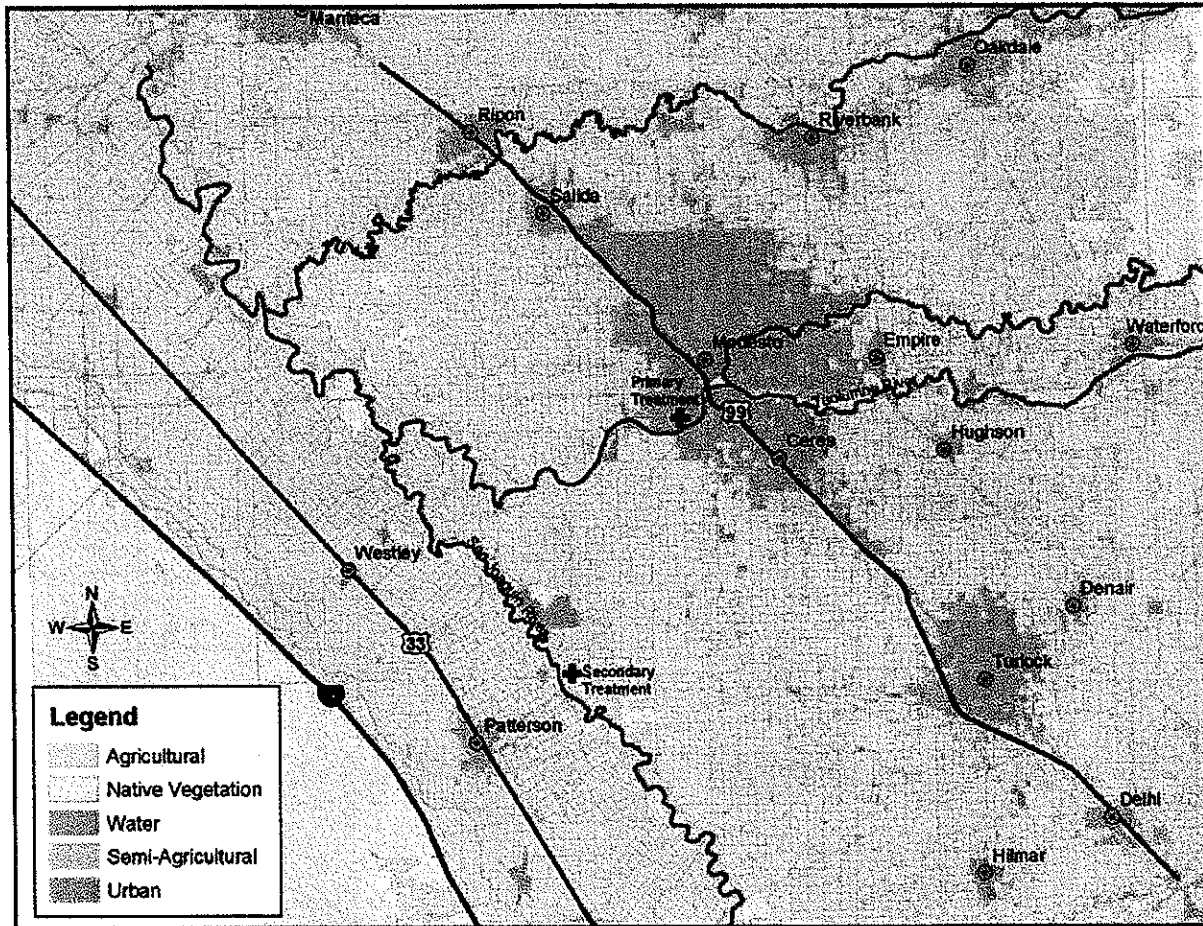
Groundwater from the Tuolumne/Stanslaus and Turlock groundwater basins are pumped by the City of Modesto for municipal and industrial use. The sustainable municipal yield of the groundwater basin is estimated to be approximately 50,000 AFY and is pumped from approximately 118 wells (B&V, 2000). Recently, several groundwater wells have had to be abandoned due to high uranium concentrations, therefore reducing the peak pumping capacity of the groundwater supply. Wells have also been abandoned due to high nitrate concentrations.

### **2.1.4 Land Use**

The primary land uses in the Northern San Joaquin Valley region are agricultural, native vegetation, native riparian, and urban land uses such as residential, commercial, and industrial. Irrigated agricultural land is located throughout the region and is supported by various irrigation Districts. MID and TID collectively supports over 200,000 acres of irrigated agricultural land in the region. Crops grown in the region include almonds, alfalfa, peaches, nectarines, corn, grapes, and other fruits and vegetables.

The Cities of Modesto, Turlock, and Manteca are the major urban area in the region with populations greater than 50,000. The region also is host to a number of smaller cities located throughout the valley. Urban areas in the region continue to expand as the cities in the region grow. Agricultural land has been and is expected to continue to be converted to urban uses to allow growth. Figure 2-1 shows the land use and the City's primary and secondary wastewater treatment plants.

**Figure 2-1: Northern San Joaquin Valley Land Use and City of Modesto Wastewater Treatment Plants**



## 2.2 Wastewater Needs

The City of Modesto Wastewater Treatment Facilities are located on two sites, separated by approximately 7 miles. The Sutter Avenue primary plant (headworks, primary clarification, and solids handling) is adjacent to the Tuolumne River, within a residential area. The Jennings Street secondary plant (oxidation ponds, storage, and ranchlands) is within an agricultural region adjacent to the San Joaquin River. Figure 2-1 shows the location of the two Wastewater Treatment Plants (WWTP's) in relation to urban and agricultural centers.

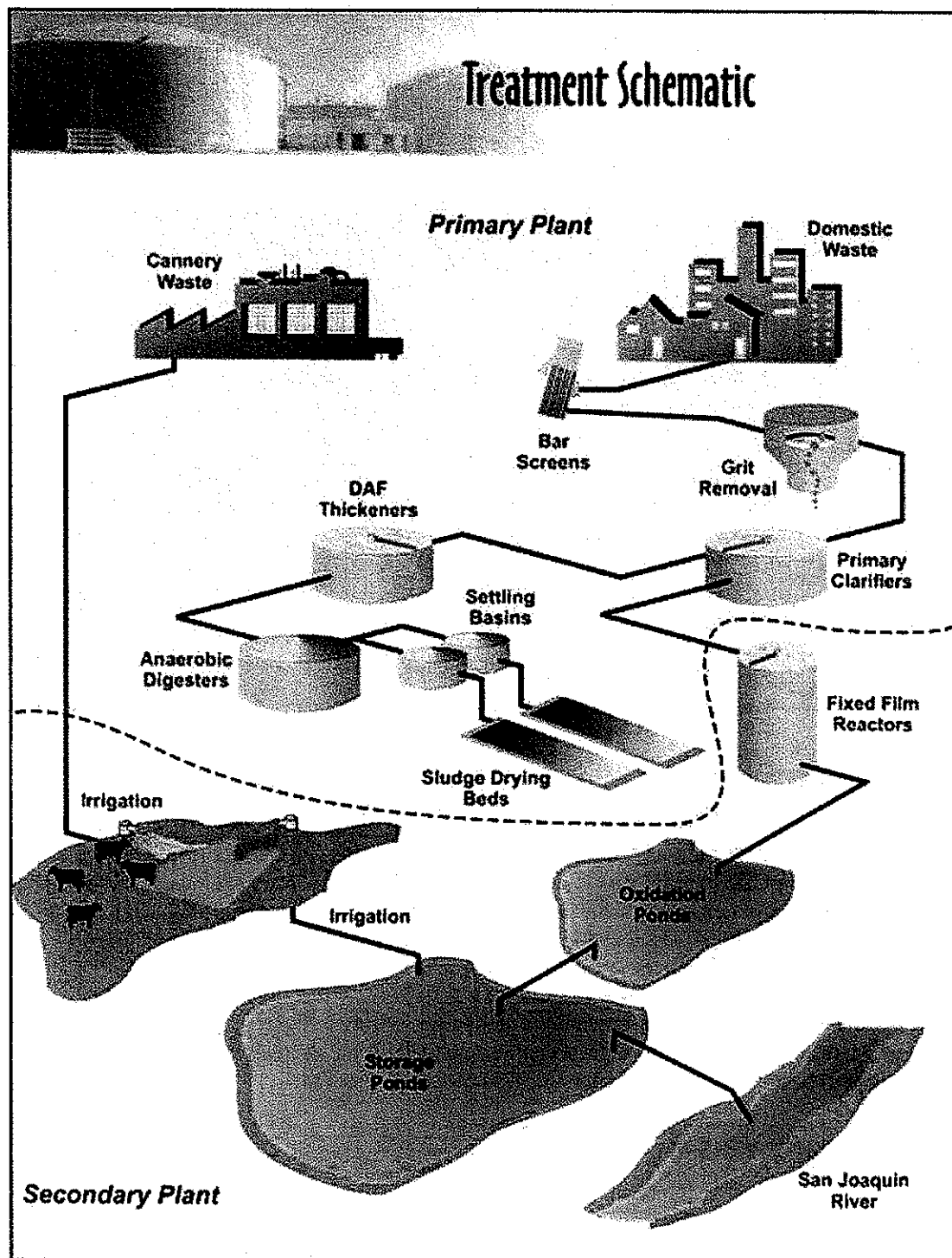
This section summarizes the wastewater treatment and disposal setting in the region but primarily focuses on the City of Modesto. For additional information and details on the wastewater treatment issues, facilities, and flows refer to Appendix D Water and Wastewater Needs TM.

### 2.2.1 City of Modesto Existing Facilities

Figure 2-2 presents a treatment schematic of the existing City of Modesto WWTP. Domestic wastewater is treated at the primary treatment plant. After primary treatment, effluent from the primary plant is pumped approximately 7 miles to the secondary plant through twin 60-inch outfall pipelines. There the

primary effluent is treated further and either applied to the ranchland or discharged to the river within restricted months. Wastewater from the seasonal canneries is segregated from domestic wastewater flows, and is applied directly to the City-owned ranchlands.

Figure 2-2: City of Modesto WWTP Treatment Schematic



## 2.2.2 Current and Future Wastewater Flows

Wastewater flows as reported by the City of Modesto WWTP personnel from 2000 to 2002 are presented in Table 2-1. Discharges to the secondary plant ranch and San Joaquin River are seasonal.

**Table 2-1: Modesto Primary and Secondary Wastewater Treatment Plant Flows-Yrs 2000-2002**

Process Component	Average Flow (mgd) <sup>a</sup>	Season
Primary Influent	24.5	Year Round
Segregated Cannery Waste to Ranch	16.4	July-Sept
Secondary WW Irrigation to Ranch	13.0	Year Round; varies with weather, soil conditions.
Secondary WW Discharge to San Joaquin River	25.5	Nov (or Dec)-May; varies with available water quality, and river flows. NPDES permitted discharge Oct 1-May 31.

Footnotes:

a. Reported monthly average flow is based on data provided by City of Modesto for period from January 2000 to December 2002.

The 1995 Wastewater Master Plan provided flow projections through the year 2015, reproduced herein as Table 2-2.

**Table 2-2: Year 2015 Projected Wastewater Flows (mgd)**

Flow Component	Regular Season	Canning Season	Normal Infiltration/Inflow (I/I)	Normal and Intentional I/I
Avg. Daily Dry	54.62	54.62	-	-
Large Industrial Users	3.81	24.82	-	-
Total	58.43	79.44	-	-
Peak Dry Weather	72.36	93.37	-	-
Peak Wet Weather, 1-Year Storm	-	-	81.19	103.69
Peak Wet Weather, 5-Year Storm	-	-	96.26	108.76

Domestic wastewater flows have increased only slightly (11% from 22.0 to 24.5 mgd) from 1994 to 2004 and cannery segregation flows have actually declined (33% from 24.8 mgd to 16.4 mgd) over the same period. A 2003 study of the City's water demands determined a similar trend over the last three years (1999, 2000, and 2001) metered (non-residential consumption has decreased about 19%, while unmetered (residential) consumption has increased by about 18%. This is likely due to the shutdown or slowdown in production by the area's industrial and food processing facilities, which is evidenced by a decrease in water use by the City's highest water users, together with an increase in residential development.

Despite an increase in applications for industrial water and sewer service, future wastewater flows are unlikely to reach the elevated levels shown in Table 2-2 for the year 2015. A wastewater master plan update is currently being prepared and will provide revised wastewater flow projections.

## 2.2.3 Disposal Capacity

Wastewater disposal is a primary driver for recycled water projects because reclamation is an effective disposal method. Currently, disposal of the City of Modesto's secondary effluent is achieved through land reclamation, San Joaquin River discharge, pond system evaporation, and pond system percolation.

The City's disposal operations are regulated under the National Pollutant Discharge Elimination System (NPDES) and Water Discharge Requirement (WDR) permit systems.

Discharge of secondary effluent to the San Joaquin River between October 1 and May 31 is limited by dilution requirement of 20 part river water to one part secondary effluent in the City's NPDES permit. Discharge of secondary effluent and cannery waste to the ranch is limited by organic loading limitations of the NPDES permit, allowable pasture irrigation rates (5 acre-feet per year per acre), and available acreage. Other weather and soil-related factors that affect disposal capacity include evaporation rates and percolation. The City of Modesto Water Quality Control Plant Master Plan Update (March 2002) prepared a summary of annual disposal capacities in a dry year (2000/2001), reproduced as Table 2-3. The final row of the table accounts for the volume of additional secondary effluent that could have been disposed of to the San Joaquin River in 2000/2001 if suspended solids were decreased below the NPDES permitted 45 mg/l (through an additional treatment process). High suspended solids limited disposal to the river.

**Table 2-3: Summary of Annual Disposal Capacities in Dry Year Conditions**

Component	Quantity (billion gallons)
River Discharge Oct-Nov	0
River Discharge Dec-May	3.0
Cannery Wastes to Ranch	1.0
Secondary Effluent to Ranch	3.1
Evaporation from Ponds	1.5
Percolation from Ponds	1.1
<b>Total Disposal Capacity</b>	<b>9.7</b>
Flow to be Disposed of	10.2
Additional Capacity Needed	0.5
Additional River Discharge Capacity Available with Suspended Solids Removed in October and November	0.6

During a dry year, Modesto is expected to have a disposal capacity shortfall of approximately 500 million gallons (Cortinovis, 2001). The City is in the process of implementing a Dissolved Air Floatation project to increase disposal capacity to the San Joaquin River with operation expected in 2005. This is expected to meet current capacity needs but does not provide for future wastewater flow increases in a dry year.

## 2.2.4 Potential Stakeholders Facilities and Flows

A number of the stakeholders identified in Section 1 own and operate WWTP's. Figure 1-1 shows the location of stakeholders that operate wastewater treatment facilities. A stakeholder workshop was held to initiate discussions with potential partners on the regional project concept. Interested parties were identified and used as a basis to develop regional concepts which are discussed further in Section 4. Information about existing facilities was gathered from stakeholder questionnaires as well as in NPDES and WDR permits. Table 2-4 summarizes the wastewater treatment plant design flows and existing wastewater flows.

**Table 2-4: Stakeholder Facility Design Flow and Existing Wastewater Flows**

City	Design Flow	Actual Flow
Turlock (including Ceres)	20 mgd ADWF	10.3 mgd ADWF
Manteca/ Lathrop	6.95 mgd	5.3 mgd
Patterson (includes Grayson)	1.3 mgd ADWF	0.85 mgd ADWF
Oakdale	2.4 mgd	1.3 to 3.1 mgd flow
Riverbank	7.9 mgd ADWF	1.3 mgd WW and 4.0 mgd cannery waste (July-Oct)
Waterford	0.45 mgd (as of 1994)	0.582 mgd
Hughson	0.8 mgd ADWF, 2.33 mgd PWWF	0.5 ADWF, 1.2 PWWF
Delhi	0.4 mgd (as of 1996), 0.8 mgd expected 1998	0.37
Ripon	2.34 mgd	1.1 mgd
Salida	1.2 mgd	1.2 mgd
Escalon <sup>a</sup>	-	-
Westley	-	-
Grayson	-	-

Notes:

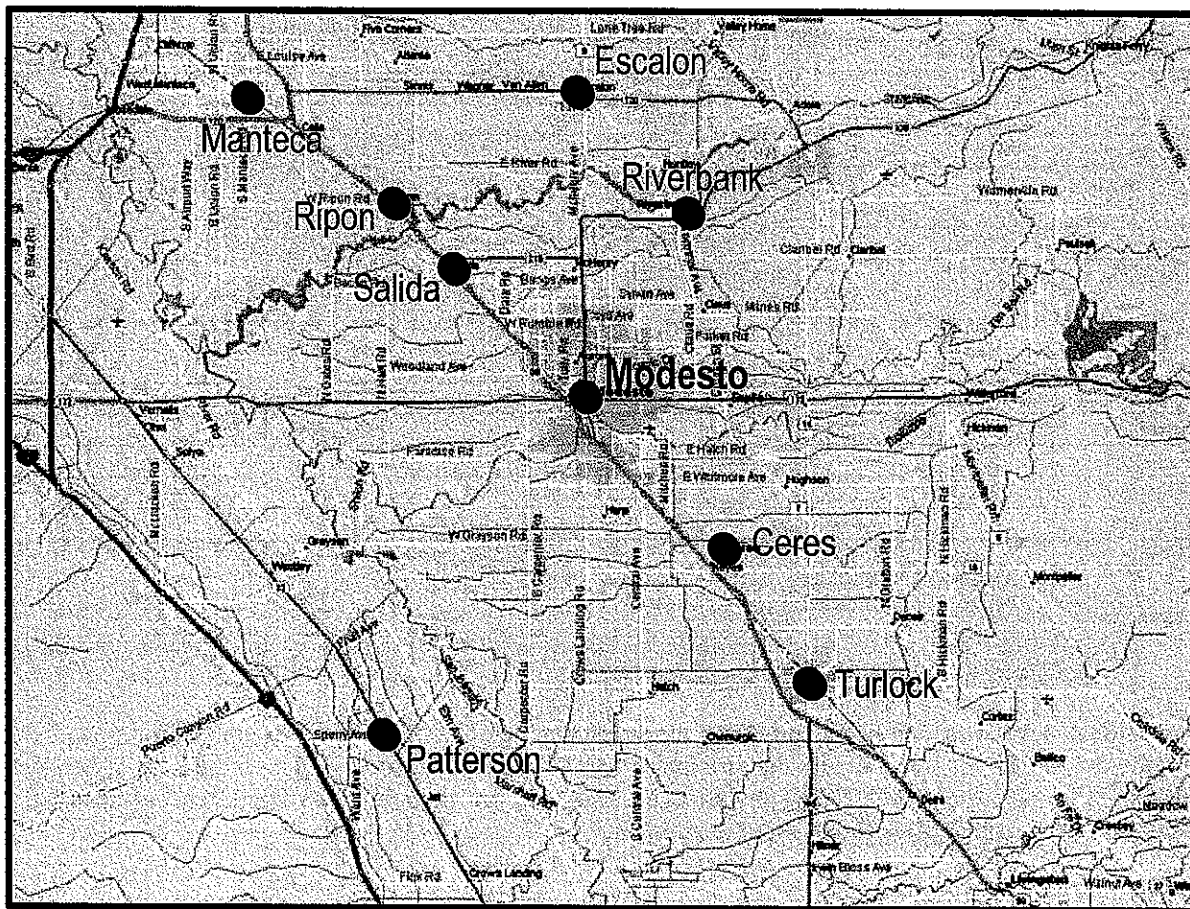
1. ADWF – Average Dry Weather Flow
2. PWWF – Peak Wet Weather Flow

Footnote:

- a. Escalon flow data obtained through Stakeholder Questionnaire administered September 9, 2003 was limited to “We have approximately 3.4 mgd from 2 food processors June to November.”

Additional details on treatment and disposal issues for the stakeholders are available in Appendix D. Figure 2-3 shows the stakeholders that are interested in a potential partnership with the City of Modesto. It should be noted that several stakeholders (i.e. Oakdale) are thought to be interested but have yet to actively participate in discussions about the project.

**Figure 2-3: Geographic Location of Potential Regional Partners**



### **2.2.5 Current Sewer Rates and Connection Fees**

Recycled water projects typically provide wastewater treatment and disposal benefits. These benefits allow a portion of the recycled water project to be funded through sewer rates and connection fees. Table 2-5 summarizes the sewer rates and connection fees for several cities in the region. It should be noted that cities typically try to maintain sewer rates and fees that are comparable to surrounding cities. Significantly higher rates can have economic impacts on associated businesses and developments.

**Table 2-5: Sewer Charges in Northern San Joaquin Valley Region**

City/Agency	Total Monthly Charge	Typical Residential Connection Fee
Ceres	\$10.80	\$1,353
Hughson	\$16.25	\$0
Lathrop	\$14.74	\$3,037
Manteca	\$9.22	\$3,882
Modesto	\$11.29	\$2,819
Oakdale	\$10.25	NA
Patterson	\$13.13	\$2,800
Turlock	\$21.25	\$791
California State Average	\$20.17	\$2,486

Note:

1. These are residential rates per month.
2. 9,000 gallons per month per household was assumed for rate structures based on volume.

## **2.3 Water Supply and Needs**

This section summarizes the City of Modesto service area water supply and use. Water supply and use information is based on the *2000 Urban Water Management Plan* by Black and Veatch and the *City of Modesto Water System Hydraulic Model Update Final Water Demand Evaluation* by West Yost and Associates. For additional details on the water supply and use setting, refer to Appendix D Water and Wastewater Needs TM or the two reports above.

The City of Modesto's water service study area is defined by the City's Urban Area General Plan and Empire, Salida, a portion of South Modesto/Ceres, Del Rio, Grayson, Waterford, Hickman, and portions of Turlock. The total build-out of the study area is approximately 42,700 acres. MID, which supplies surface water for domestic use, owns two reservoirs: Don Pedro Reservoir (co-owned by TID) and Modesto Reservoir, with a maximum storage of 2,030,000 and 28,000 acre-feet (AF) respectively.

Groundwater and surface water are the major source for the City of Modesto. The City owns and operates over 100 groundwater wells that provide average daily supply of approximately 40 mgd. The surface water supply for the City's water system is provided by MID from the Tuolumne River. The MID Water Treatment Plant provides an average daily flow capacity of 30 mgd. In 2002, the City of Modesto's average total daily production was approximately 73.3 mgd (entire service area) with an annual production total of 82,100 AF (West Yost & Associates, March 2003). Table 2-6 shows the City of Modesto water production for 2002 by service area.

Surface water supplies from MID are expected to provide at least a proportion of the supply for future water demand increases. MID has significant water rights and should be able to meet all of the projected growth over the next 20 years. A 30 mgd expansion of the MID surface water treatment plant is in the process of being implemented to help meet future needs. Following expansion, the City's total production capacity will be 112,102 AFY. Water use is expected to increase to approximately 122,200 AFY at the current general plan build-out level (West Yost & Associates, March 2003).

Other potential future water supplies include a TID surface water treatment plant, increased water conservation including meters, and recycled water to offset potable water demand such as landscape irrigation (City of Modesto, December 2003).

**Table 2-6: City of Modesto Water System 2002 Annual Water Production by Service Area**

Service Area	2002 Total Production, gallons	2002 Total Water Production, acre-feet	2002 Average Day Water Production, mgd
City of Modesto (including South Modesto and Empire):			
MID Surface Water Supply	11,018,644,328	33,817	30.2
Groundwater	13,463,556,165	41,221	36.9
<b>Total City of Modesto (including South Modesto and Empire)</b>	<b>24,482,200,493</b>	<b>75,038</b>	<b>67.1</b>
Salida <sup>a</sup>	960,567,000	2,948	2.6
Ceres <sup>b</sup>	21,573,000	66	0.1
<b>Subtotal Contiguous Portion of Water System</b>	<b>25,464,340,493</b>	<b>77,153</b>	<b>69.8</b>
Del Rio	222,291,146	682	0.6
Grayson	157,209,434	482	0.4
Waterford	659,790,000	2,025	1.8
Hickman	71,264,000	219	0.2
Turlock	186,222,900	541	0.5
<b>Modesto Water System Total</b>	<b>26,751,117,973</b>	<b>82,102</b>	<b>73.3</b>

**Footnotes:**

- Water production shown for Salida does not include the transfer from City of Modesto. Water transferred to Salida from City of Modesto (1,051,246,680 gallons (about 2.9 mgd) in 2001 is included in City of Modesto production total.
- Production shown reflects only groundwater production from Well 213 which serves a small isolated area in Ceres. Remaining groundwater production in South Modesto/Ceres is included in the City of Modesto groundwater production.

### 2.3.1 Current Water Rates and Connection Fees

As part of our evaluation of how recycled water will be integrated into future water supply strategies, it is helpful to compare and contrast the current cost of potable water service for neighboring communities. Select total monthly charges and typical residential connection fees for potable water service, provided in the Black & Veatch *California Water Charge Survey 2001*, are included in Table 2-7.

**Table 2-7: Water Service Charges in Northern San Joaquin Valley Region**

City/Agency	Total Monthly Charge	Typical Residential Connection Fee
Delhi	\$12.00	\$2,000
Manteca	\$15.65	\$2,222
Modesto	\$20.60	\$2,100
Patterson	\$15.28	\$2,282
Turlock	\$12.60	\$4,420
California State Average	\$28.67	\$2,910

### **3 Market Assessment**

This section summarizes the recycled water market assessment that was completed for the Northern San Joaquin Valley Water Reclamation Project. Potential customers throughout the region and outside the region were investigated to assess the opportunity for recycled water use. For additional details on the market assessment, refer to Appendix B.

This section is organized as follows:

- Urban Market
- Agricultural Market
- Water Sale
- Environmental Uses
- Groundwater Recharge
- Water Quality
- Market Assessment Findings and Conclusions

These potential markets were investigated and evaluated to identify potential demands for recycled water. It should be noted that this market assessment represents a preliminary review of the potential markets. More detailed investigations are needed to assess customer needs, operations, and recycled water delivery. Additionally, market assurances would need to be obtained from potential customers if a recycled water project was found to be economically feasible and implemented by the City. The market assurances include letters of intent or contracts with water customers and/or a mandatory recycled water use ordinance. Obtaining market assurances was not part of this Feasibility Study.

#### **3.1 Urban Market**

The potential urban market includes landscape irrigation, industrial reuse, and other non-potable uses. Parks, golf courses, schools, the top 50 industrial water users, and dual plumbing of new developments were identified as the potential urban market. Landscape irrigation demands for the parks, golf courses, and schools were estimated based on a consumptive use methodology. The top 50 industrial water users primarily consist of food processors. Based on correspondence with Gallo wineries, cooling water is a major demand at their food processing facilities. Recycled water use for other food processors needs to be more thoroughly investigated to determine actual feasibility. However, it was assumed that 50% of the industrial water use could be supplemented by recycled water.

The City's golf courses and several of the major parks are currently irrigated by non-potable wells or with untreated surface water from MID irrigation canals. The current water source for potential users needs to be factored into determining the cost effectiveness of proposed recycled water projects.

The City of Modesto has identified a number of new developments (Comprehensive Planning Districts (CPDs)) that could be dual plumbed for recycled water use. Non-potable water use for these dual plumbed CPDs were evaluated based on previous studies. Table 3-1 summarizes the overall estimated landscape irrigated acreage and the annual water demand for the urban market. Figure 3-1 shows the location of parks, schools, and golf courses in the City of Modesto Service Area.

**Table 3-1: Summary of Estimated Annual Potential Urban Recycled Water Demand**

Use Type	Irrigated Acreage	Unit Water Demand (af/ac)	Total Demand (af/yr)
Industrial	n/a	n/a	4,900 <sup>a</sup>
Parks/Golf Courses	872	3.3	2,900
Schools	566	3.3	1,900
CPDs	n/a	n/a	16,000 <sup>b</sup>
<b>Total</b>			<b>25,600</b>

Note:

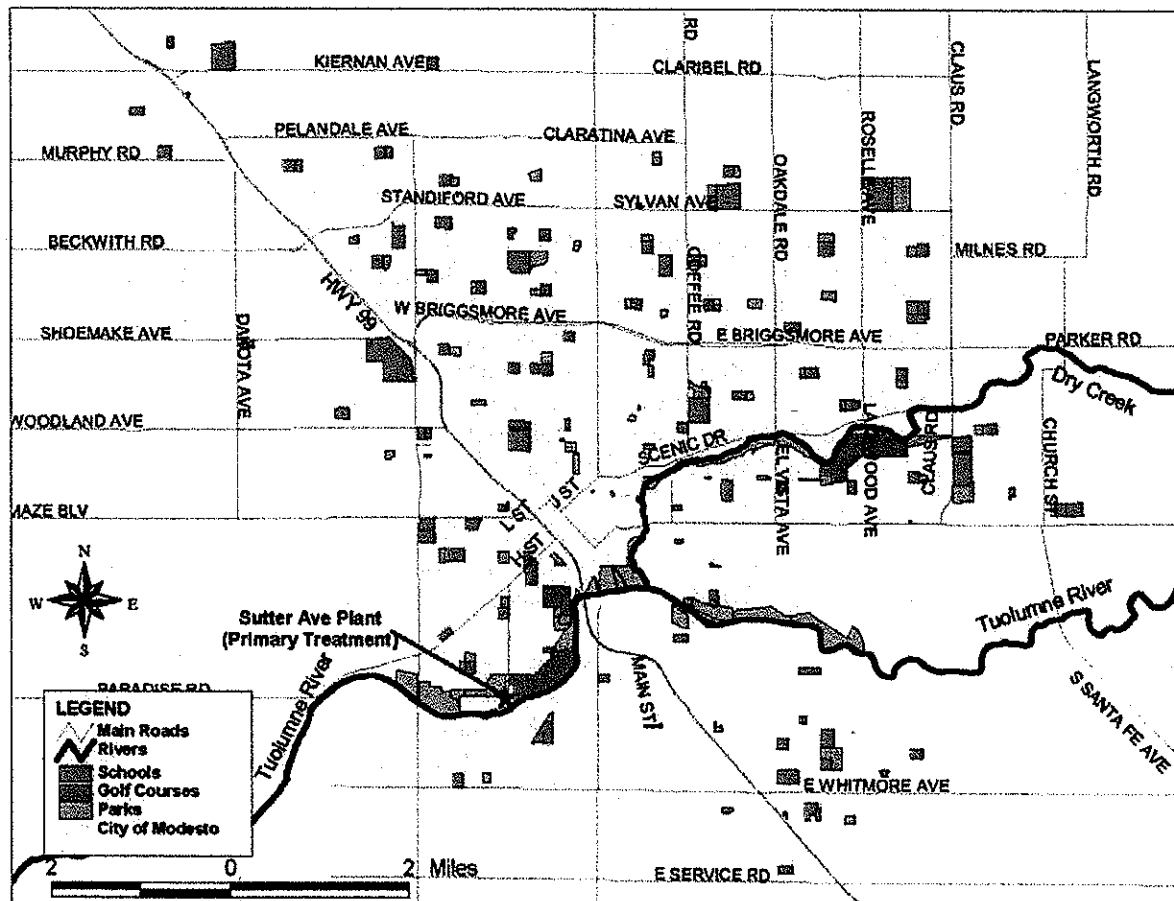
1. The Total Demand column is rounded to the nearest hundred.

Footnotes:

- a. The potential industrial demand is estimated using the City of Modesto water use records for the top 50 industrial users for 2001 and 2002. Potential urban recycled water demand was assumed to be 50% of the total average water use for the top 50 industrial users based on a discussion with one industrial user.
- b. CPDs demand was estimated based on the *Water System Hydraulic Model Update Final Water Demand Evaluation* by West, Yost, & Associates (March 2003) and assuming 50% outdoor water use.

The estimated urban recycled water demand of 25,600 AFY represents the overall recycled water of the City of Modesto's sewer service area and did not consider cost constraints and other limitations. Service areas were developed during the alternatives development phase of the project when recycled water facility locations were identified.

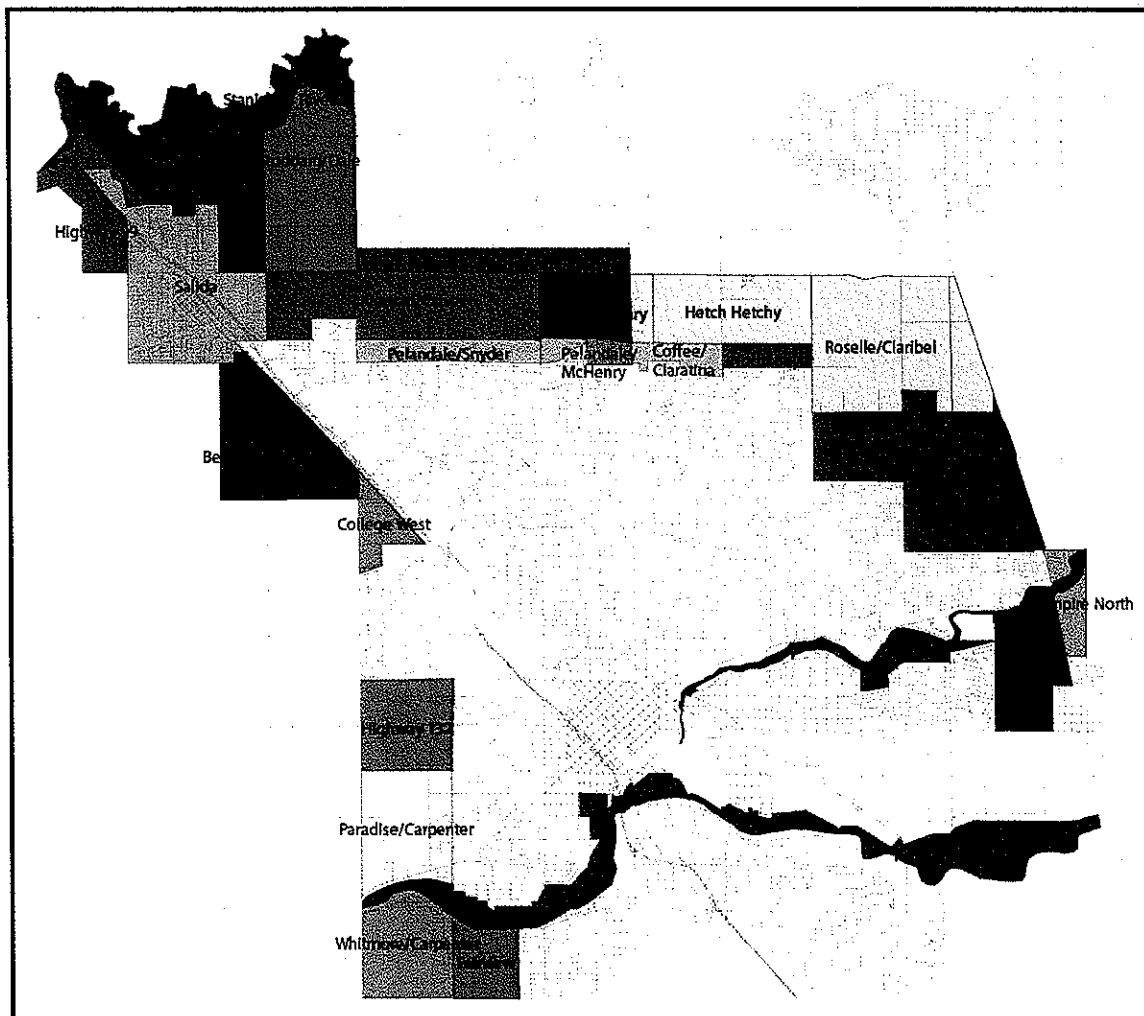
**Figure 3-1: Potential Recycled Water Customers: Parks, Schools, and Golf Courses**



New developments provide a more cost effective opportunity to implement dual plumbed systems to allow for recycled water use. Figure 3-2 shows the location of the CPDs. The location of each CPD is a major factor that could limit the feasibility of serving recycled water to some developments. The feasibility of delivering recycled water to the CPDs will depend on the location of the recycled water facilities and infrastructure costs to deliver water to each of the CPDs.

Several CPDs are located near the City's primary WWTP and would lend themselves to receiving recycled water from the plant. However, with the exception of the Fairview CPD, the CPDs in the southwestern portion of the City are not expected to be developed within the next 10 to 15 years. The next areas to be developed are those CPDs in to the North and Northeast. These areas are a long way from the City's Primary WWTP and would require sewer collection systems. Because of their distance from the plant and the potential for avoided costs, satellite treatment plants should be considered for these areas.

**Figure 3-2: Potential Comprehensive Planning Districts**



Source: City of Modesto, "Urban Area General Plan," March 4, 2003.

### **3.1.1 Urban Market Findings and Conclusions**

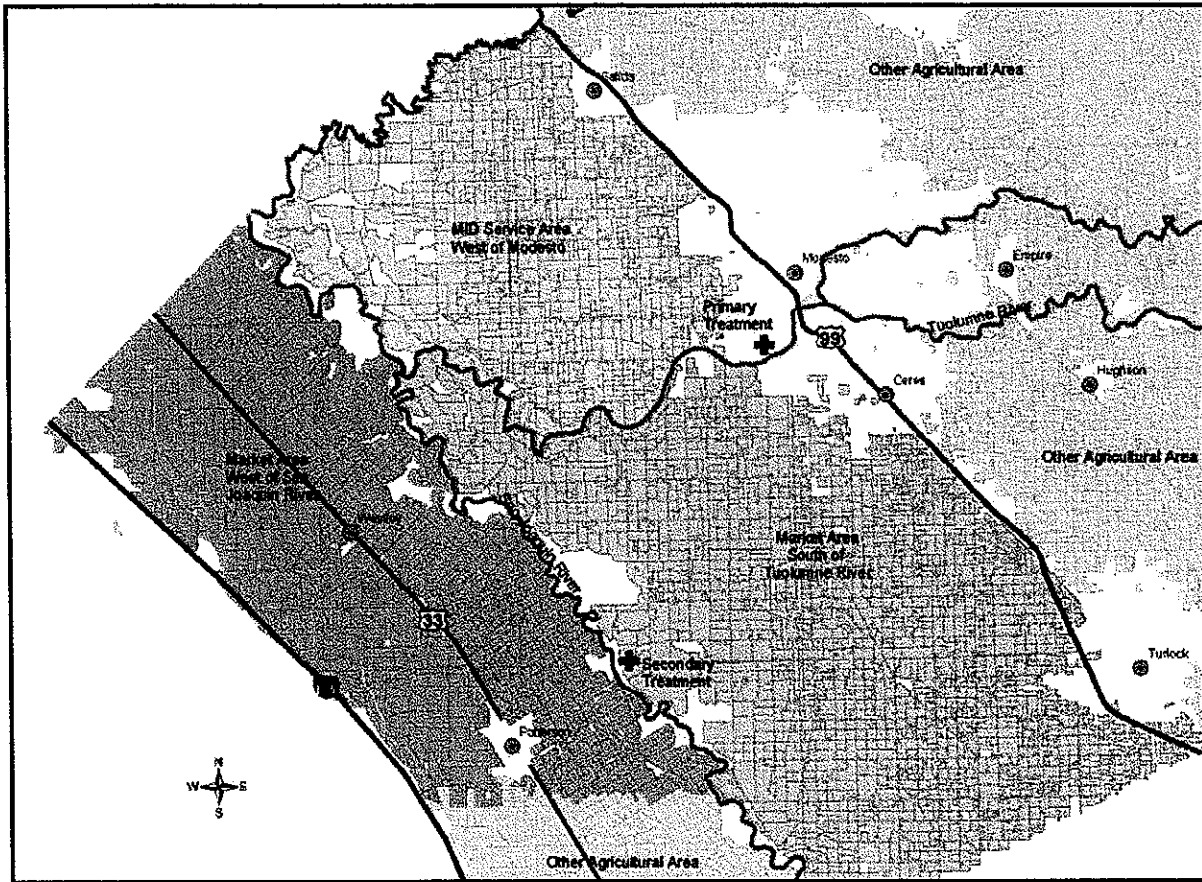
Alternative urban water recycling projects in the City of Modesto area would be served through recycled water treatment at the existing primary treatment facility or via a new satellite treatment facility located near the potential recycled water use sites. Potential urban recycled water projects are described and evaluated in Section 5. After a preferred alternative has been identified, more detailed evaluations will refine quality and quantity requirements.

An urban recycled water project would require significant public outreach efforts to garner support for the project. Public perception, water quality issues, regulatory issues, reliability issues, and stakeholder input could be addressed as part of the outreach efforts. Implementation of an urban recycled water project is more institutionally feasible than an agricultural project as the City of Modesto is the major stakeholder and would provide service within their water service area.

## **3.2 Agricultural Market**

As previously described in Section 1, the Northern San Joaquin Valley Region is an agriculturally rich area that grows a variety of fruit, nuts, vegetables, and other crops. Local agricultural irrigation is a significant opportunity to use recycled water beneficially. However, agricultural lands in the region west of the San Joaquin River are served by either MID or TID, both of which have rights to high quality, highly reliable, and inexpensive (\$4.86 per AF (April 2004)) Tuolumne River water. Figure 3-3 shows the potential MID (portion of MID service area), West of the San Joaquin River, and South of Tuolumne River (portion of TID) agricultural market areas that were evaluated.

**Figure 3-3: Potential Agricultural Market Areas**



A consumptive use methodology was used to develop annual, monthly, and peak water use factors. Potential recycled water demands in the MID and TID service areas far exceed the existing recycled water flow. The demand for each potential market area is summarized in Table 3-2. The estimated annual irrigation water demand ranges from about 3.52 to 3.67 acre-feet per acre. Total estimated annual demand for the combined area is 389,365 acre-feet.

**Table 3-2: Summary of Estimated Annual Irrigation Water Demand**

Market Area	Irrigated Acreage	Annual Gross Water Appl. Requirement	
		Total AF	AF/Acre
MID (Portion)	37,748	138,362	3.67
TID (Portion)	71,351	251,003	3.52
<b>Total</b>	<b>109,099</b>	<b>389,365</b>	<b>3.57</b>

Delivery of recycled water to local agriculture would likely necessitate the use of MID and/or TID irrigation facilities, depending on the location of the areas of identified recycled water use. Contractual agreements would be needed to arrange for water conveyance and water service. The parties involved in these agreements would likely be the City of Modesto, the various water agencies/districts and the RWQCB.

1. The first part of the document discusses the importance of maintaining accurate records of all transactions and the role of the accounting system in providing reliable financial information. It emphasizes the need for transparency and accountability in financial reporting.

2. The second part of the document outlines the various methods used to collect and analyze financial data, including the use of spreadsheets, databases, and specialized accounting software. It also discusses the importance of regular audits and the role of external auditors in ensuring the accuracy of the financial statements.

3. The third part of the document focuses on the presentation of financial information, including the preparation of financial statements and the use of visual aids such as charts and graphs to enhance the clarity and readability of the data. It also discusses the importance of providing clear and concise explanations of the financial results.

4. The fourth part of the document discusses the role of the accounting system in providing valuable insights into the company's financial performance and the ability to identify areas for improvement. It also discusses the importance of maintaining accurate records of all transactions and the role of the accounting system in providing reliable financial information.

5. The fifth part of the document discusses the importance of maintaining accurate records of all transactions and the role of the accounting system in providing reliable financial information. It emphasizes the need for transparency and accountability in financial reporting.

6. The sixth part of the document outlines the various methods used to collect and analyze financial data, including the use of spreadsheets, databases, and specialized accounting software. It also discusses the importance of regular audits and the role of external auditors in ensuring the accuracy of the financial statements.

7. The seventh part of the document focuses on the presentation of financial information, including the preparation of financial statements and the use of visual aids such as charts and graphs to enhance the clarity and readability of the data. It also discusses the importance of providing clear and concise explanations of the financial results.

8. The eighth part of the document discusses the role of the accounting system in providing valuable insights into the company's financial performance and the ability to identify areas for improvement. It also discusses the importance of maintaining accurate records of all transactions and the role of the accounting system in providing reliable financial information.

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11. The eleventh part of the document focuses on the presentation of financial information, including the preparation of financial statements and the use of visual aids such as charts and graphs to enhance the clarity and readability of the data. It also discusses the importance of providing clear and concise explanations of the financial results.

12. The twelfth part of the document discusses the role of the accounting system in providing valuable insights into the company's financial performance and the ability to identify areas for improvement. It also discusses the importance of maintaining accurate records of all transactions and the role of the accounting system in providing reliable financial information.

13. The thirteenth part of the document discusses the importance of maintaining accurate records of all transactions and the role of the accounting system in providing reliable financial information. It emphasizes the need for transparency and accountability in financial reporting.

14. The fourteenth part of the document outlines the various methods used to collect and analyze financial data, including the use of spreadsheets, databases, and specialized accounting software. It also discusses the importance of regular audits and the role of external auditors in ensuring the accuracy of the financial statements.

15. The fifteenth part of the document focuses on the presentation of financial information, including the preparation of financial statements and the use of visual aids such as charts and graphs to enhance the clarity and readability of the data. It also discusses the importance of providing clear and concise explanations of the financial results.

16. The sixteenth part of the document discusses the role of the accounting system in providing valuable insights into the company's financial performance and the ability to identify areas for improvement. It also discusses the importance of maintaining accurate records of all transactions and the role of the accounting system in providing reliable financial information.

17. The seventeenth part of the document discusses the importance of maintaining accurate records of all transactions and the role of the accounting system in providing reliable financial information. It emphasizes the need for transparency and accountability in financial reporting.

18. The eighteenth part of the document outlines the various methods used to collect and analyze financial data, including the use of spreadsheets, databases, and specialized accounting software. It also discusses the importance of regular audits and the role of external auditors in ensuring the accuracy of the financial statements.

19. The nineteenth part of the document focuses on the presentation of financial information, including the preparation of financial statements and the use of visual aids such as charts and graphs to enhance the clarity and readability of the data. It also discusses the importance of providing clear and concise explanations of the financial results.

20. The twentieth part of the document discusses the role of the accounting system in providing valuable insights into the company's financial performance and the ability to identify areas for improvement. It also discusses the importance of maintaining accurate records of all transactions and the role of the accounting system in providing reliable financial information.



### 3.3.3 Westlands Water District (WWD)

WWD is located on the west side of Fresno and Kings Counties. The district is a CVP contractor and receives water from the Delta Mendota Canal. WWD has a significant water shortfall that results in annual land fallowing. Conceptually, deliveries of Modesto recycled water could occur via the Delta Mendota Canal (DMC) or through dedicated pipeline conveyance facilities constructed to provide water service to selected water users. Use of the DMC faces potential negative perception and water quality issues.

The DMC provides CVP water supply to numerous water agencies and districts including municipal and industrial (M&I) water supplies for the Santa Clara Valley Water District (SCVWD) and Metropolitan Water District of Southern California (MWD). Water from the DMC is diverted to the O'Neill Forebay and San Luis Reservoir, which provides supply for these two districts. Additionally, the Exchange Contractors, which receive their water supply from the Mendota Pool, also have water quality concerns that could be exacerbated by recycled water delivery in the DMC. Additional investigations and discussions with stakeholders need to be completed to assess the feasibility of using the DMC to convey recycled water. Dedicated recycled water conveyance facilities for water sale would be less complex to implement, as impacts to other DMC contractors would not be a factor. However, dedicated facilities are only practical over short conveyance lengths or for significantly greater volumes of recycled water delivery, as infrastructure costs would limit the feasibility of a project.

### 3.3.4 Other CVP Contractors

Other CVP contractors may be interested in recycled water as their CVP contracts contain provisions that allow for reductions in annual delivery amounts depending on the amount of water available for each water year. The USBR makes forecasts of water supply availability each spring and adjusts the actual amount of water delivered. CVP south of Delta water supply allocation for agriculture over the last six years averaged approximately 72 percent of the CVP contract amount, or a reduction of 28 percent from the contract amount. Table 3-3 summarizes the annual south of delta allocations from 1998 to 2003.

Table 3-3: 1998-2003 CVP Allocations South of Delta

Year	Percent Supply	
	Agricultural Contractors	Urban Contractors
1998	100	100
1999	70	95
2000	65	90
2001	49	77
2002	70	95
2003	75	100
Average	72	93

Additional investigations may result in the identification of other opportunities with CVP contractors.

### 3.3.5 Water Sale Finding and Conclusions

This section summarizes the preliminary findings and conclusions of the water sale investigation. Water sale is thought to be a viable option for this water recycling project. However, it is recognized that this option may be institutionally complex due to the significant number of stakeholder interests and the range of potential options that could be investigated. It should be noted that additional evaluations and discussions with various stakeholders are necessary in order to identify interests and potential issues, and to gauge potential commitment to the project.

- IDs to the west of the San Joaquin River are the nearest agencies that could potential use recycled water from the City of Modesto's WWTP.
- Eastside ID has a water need of 70,000 to 80,000 AFY. However, due to the location of the district, it does not seem practical to directly serve recycled water to the district. A water sale agreement with a third party would likely be a more feasible approach. This would require a third party to use recycled water in order to free up surface water supply along the Tuolumne or Merced Rivers.
- CVP districts in the San Luis Unit, especially Westlands WD, appear to have unsatisfied water demand and could benefit from a recycled water supply.
- Various districts, water users, MWD and the SCVWD might object to the use of the DMC upstream of the connection to the O'Neill Forebay for recycled water conveyance.
- The use of the DMC for recycled water conveyance would likely be confined to the facility south of the connection to the O'Neill Forebay.
- The Exchange Contractors may object to the use of the DMC for recycled water conveyance if salinity increases above historic/baseline levels, even if contractual water quality requirements are met.
- DMC water quality should be assessed at various recycled water blending ratios to assess the impact on salinity and other water quality constituents.
- Other issues of concern include:
  - Recycled water quality.
  - Blending to manage salinity.
  - Tertiary treatment to allow for full unrestricted agricultural use.
  - Recycled water cost.
- The availability of recycled water for irrigation could potentially benefit CVP San Luis Reservoir operations by freeing up CVP water that could be held for summertime storage. This would provide benefits to the USBR and SCVWD.

### 3.4 Environmental Use

Environmental use of recycled water is generally driven by the anticipated environmental benefit as opposed to actual water demand. Potential opportunities for environmental uses include stream flow augmentation, wildlife habitat restoration, wetland enhancement and other related environmental purposes. One potential environmental use would be augmentation of summer flow in the San Joaquin River with disinfected tertiary recycled water. This could enhance habitat in the San Joaquin River and the delta during the summer months. Environmental uses of recycled water would need to be evaluated in a future study to assess the potential impacts to local groundwater supplies, agricultural lands, and other environmental habitats. Based on correspondence with the Central Coast Regional Water Quality Control Board (RWQCB), augmentation of flow in the San Joaquin River is not currently viewed as a benefit.

Another potential opportunity for environmental enhancement is at the San Joaquin River National Wildlife Refuge (SJRNR). The US Fish and Wildlife Service (USFWS) is restoring historic wetlands that are located adjacent to the San Joaquin River. The SJRNR is located approximately 10 miles west of the City of Modesto and is part of the Pacific Flyway that supports migratory waterfowl. Currently the USFWS plans to utilize water from the San Joaquin River to flood the wetland during periods of waterfowl migration. River water would be introduced to the wetlands passively during high flow events and through pumping. Based on correspondence with Eric Hopson of the USFWS, the pumped flow would only be about 2 cubic feet per second (cfs) starting in October or November with diversions possible continuing into early spring. Operation of the wetlands would try to emulate historic conditions with winter wetting cycles and summer dry cycles. Additional coordination with the USFWS is necessary to identify the opportunity for recycled water use in the SJRNR.

Recycled water could also be used to develop constructed wetlands to provide habitat for endangered species and other wildlife. Constructing/developing wetlands in the area would probably require conversion of agricultural land or modification of other land uses.

Recycled water quality is a significant consideration for environmental use since pharmaceuticals, trace elements, pesticides, and other constituents could potentially result in adverse impacts to aquatic species. The quality of recycled water required for environmental use is dependent on the specific uses of the water (i.e. treatment wetlands have different needs than stream flow augmentation projects). Treatment requirements and water quality goals should be evaluated in the future as specific environmental projects are identified.

### **3.5 Groundwater Recharge**

Using municipal recycled water as a source to recharge a groundwater basin used for municipal and industrial water supply purposes is an approved practice in California. Water Factory 21 in Orange County, and the Montebello Forebay project operated by the Los Angeles County Sanitation District have been in operation since the late 1970's, recharging over 50,000 acre-feet per year to the local groundwater basins. However, advanced treatment technologies (reverse osmosis (RO), ultraviolet (UV) disinfection, etc.) are necessary to remove pathogens, organics, trace elements, and other impurities prior to recharge. These technologies are expensive to construct and operate, and typically reduce the project yield by as much as 25 percent (due to residuals and brine byproduct). Brine byproduct disposal would be an additional challenge for a groundwater recharge project. It is unlikely that the brine byproduct would be an allowable discharge to any inland surface water. Evaporation/crystallization process, blending and use for irrigation, or some other disposal process would need to be implemented in conjunction with the RO facilities.

Groundwater recharge using recycled water can be accomplished by percolation or injection. Recharge could be practiced year round or seasonally, and could be implemented with other potential recycled water uses. With recharge, recycled water would commingle with groundwater and be transported via the aquifer system to existing wells. Percolation basins could be located in areas with high recharge potential. Injection wells could also be constructed, but would need to be spaced to reduce groundwater mounding and would require a distribution header system.

Groundwater is a major part of the water supply for the City of Modesto. The estimated safe yield of the groundwater basin is approximately 50,000 AFY (B&V, 2000). A groundwater recharge project could increase the annual groundwater basin safe yield. Water quality constituents of concern in any domestic groundwater supply include salinity, nitrates, certain trace elements, hardness, iron, and manganese. The use of reverse osmosis for water treatment prior to recharge would probably enhance basin groundwater quality.

Regulatory requirements for groundwater injection are extremely complex and costly to comply. Another factor is the availability of surplus treated surface water in the winter for groundwater injection, which has far fewer regulatory restrictions and requirements.

### **3.6 Water Quality**

The use of recycled water for irrigation raises a number of water quality issues related to public health and water chemistry, which affects suitability for irrigation and other potential uses. The public health aspects of recycled water irrigation are regulated by Title 22 of the California Code which is discussed further in Section 4. Given that the cropping pattern in the Northern San Joaquin Valley market areas includes agricultural crops that may be consumed raw, the potential for direct public contact in parks and

schools, potential industrial uses and considering the provisions of Title 22, disinfected tertiary recycled water would be required for irrigation and other uses. This would generally provide for unrestricted water use for irrigation from a public health perspective. This same level of treatment, however, would not be required for continuation of the existing disposal operations that utilize treated wastewater for fodder crop irrigation. The Department of Health Services Groundwater Recharge Reuse Draft Regulations, revised in July 2003, present strict regulation of the process, as discussed in Section 4.1.6.

The suitability of water for irrigation is closely related to the type and concentration of chemical constituents present. Concerns include salinity, sodium hazard, and potential toxicity to plant foliage and roots from specific constituents. The tolerance of crops to various water quality constituents differs by crop/plant type. Furthermore, different varieties of the same crop/plant can exhibit markedly different growth response to water of similar quality. Crop tolerance to constituents in the irrigation water, soil conditions, method of irrigation, prevailing climate and management are important factors in assessing the suitability of a particular water for irrigation purposes.

Generally, the tolerance of the most sensitive crop to the water quality constituents is the basis for assessing the suitability of the recycled water for irrigation. It is important to engage service area water users during the planning process to obtain additional guidance on water quality issues. Further, water quality will be an important consideration for area districts in negotiating agreements for recycled water deliveries.

Researchers have studied crop/plant tolerance to salinity and other constituents, and have published water quality guidelines for many agricultural crops and landscape plants. The University of California (UC) has compiled this data and developed general guidelines for assessing the suitability of water for irrigation. These guidelines, summarized in Table 3-4, are general and flexible and are often modified based on local experience and special conditions of crop, soil, and method of irrigation.

**Table 3-4: Guidelines for Interpretation of Water Quality for Irrigation**

Problem and Related Parameters	Units	Water Quality Guidelines		
		No problem	Increasing Problems	Severe Problems
<b>Salinity<sup>a</sup></b>				
Electrical Conductivity	mmhos/cm	<0.75	0.75 – 3.0	>3.0
Total Dissolved Solids	mg/l	<480	480 – 1,920	>1,920
<b>Permeability</b>				
Adjusted SAR/Rna <sup>b</sup>	units	<6.0	6.0 – 9.0	>9.0
<b>Specific ion toxicity from root absorption<sup>c</sup></b>				
Adjusted SAR/RNa	units	<3.0	3.0 – 9.0	>9.0
Chloride	mg/l	<142	142 – 355	> 355
Boron	mg/l	<0.5	0.5 – 2.0	2.0 – 10.0
<b>Foliar absorption – Sprinklers<sup>d</sup></b>				
Sodium	mg/l	<69	>69	---
Chloride	mg/l	<106	>106	---
<b>Miscellaneous</b>				
HCO <sub>3</sub> (Sprinklers)	mg/l	<90	90 – 520	>520
NH <sub>4</sub> -N and NO <sub>3</sub> -N	mg/l	<5	5 – 30	>30

Notes:

1. Source: Ayers, 1977.

Footnotes:

- a. Assumes water for crop plus needed water for leaching requirement will be applied.
- b. The adjusted SAR (adjusted sodium adsorption ratio) is calculated from an equation developed by U.S. Salinity Laboratory to include added effects of precipitation and dissolution of calcium in soils and related to carbonate/bicarbonate concentration. The adjusted SAR is defined as follows:  
Adjusted SAR =  $[Na/\sqrt{(Ca+Mg)/2}] * [1 + (8.4 - pH_c)]$   
Cation concentrations are expressed in meq/l and pH<sub>c</sub> is calculated using tables that relate to the concentration values from the water analysis. Permeability problems, related to low EC or high adjusted SAR of water, can be reduced if necessary by adding gypsum. Usual application rate per acre-foot of applied water is from 200 to about 1,000 pounds. 234 pounds of 100% gypsum added to 1 acre-foot of water would supply 1 meq/l of calcium and raise the EC about 0.1 mmhos.
- c. Most tree crops and woody ornamentals are sensitive to sodium and chloride. Most annual crops are not sensitive.
- d. Leaf areas wet by sprinklers may show a leaf burn due to sodium or chloride absorption under low humidity/high-evaporation conditions.

The City of Modesto provided some water quality data from the cannery discharges and from the secondary ponds (remote effluent). The canneries typically operate during July through September. Water quality data provided for the secondary effluent is largely for the winter months when discharges to the San Joaquin River occur. The data that have been provided are summarized in Tables 3-5, 3-6 and 3-7.

**Table 3-5: Summary of Cannery Effluent Water Quality**

Month/Year	Electrical Conductivity (umhos/cm @25°C)		
	Low	High	Average
July-00	1,002	1,976	1,334
August-00	1,133	1,942	1,568
September-00	1,242	2,220	1,602
July-01	1,204	1,600	1,398
August-01	1,440	2,910	2,005
September-01	1,450	2,840	1,893
July-02	1,157	1,659	1,450
August-02	1,413	1,860	1,582
September-02	1,386	1,769	1,531

**Table 3-6: Summary of Remote Effluent Water Quality**

Month/Year	Electrical Conductivity (umhos/cm @25°C)		
	Low	High	Average
January-00	1,117	1,221	1,159
February-00	991	1,231	1,071
March-00	925	1,052	964
November-00	1,050	1,216	1,175
December-00	997	1,180	1,126
January-01	938	1,121	1,060
February-01	988	1,008	998
May-01	930	1,064	1,037
December-01	1,055	1,200	1,162
January-02	1,031	1,150	1,091
February-02	999	1,080	1,021
March-02	941	1,013	997
April-02	985	1,020	1,001
November-02	1,126	1,161	1,143
December-02	1,045	1,171	1,076

Table 3-7 summarizes other water quality constituent of concerns that are currently monitored by the City.

**Table 3-7: Summary of Secondary Effluent Water Quality Constituents of Concern**

Water Quality Parameter	Units	Average
<b>Secondary Effluent</b>		
TDS	mg/l	732
Boron	mg/l	0.31
Ammonia (as N)	mg/l	3.4
Total Nitrate	mg/l	5.7
Phosphorus	mg/l	1.9
PH	-	7.2

Note:

1. Averages for this table were based on data from 2000 to 2002 for the November to May period.
2. For additional data, refer to Appendix D - Table 2.4.

Based on the treated effluent salinity data, the water quality of the potential recycled water supply is within an acceptable range for agricultural and landscape irrigation. However, there are some specific areas of potential water quality impacts for sensitive crops or landscaping. Of particular importance will be some of the more salt sensitive ornamental plants and agricultural crops.

Should higher water quality be needed, there are options for water quality enhancement. The potential recycled water supply could be enhanced by treating a portion of the flow with a reverse osmosis process or by blending with higher quality water. At these salinity levels, it's likely that other water quality constituents of concern would be at concentrations that create potential water quality induced problems for sensitive agricultural crops and landscape plants. Additional water quality data are needed to fully assess the suitability of the recycled water for irrigation and to develop management strategies.

Water quality is also a concern for industrial use related to consistency and scaling issues. Cooling water and boiler processes require relatively high quality water. Recycled water for cooling water processes is thought to be one of the primary opportunities for a water recycling project in the urban setting.

### **3.6.1 Water Quality Monitoring**

Future planning and analysis of recycled water irrigation opportunities requires careful consideration of recycled water quality characteristics. The City should implement a recycled water quality monitoring program to include the following constituents. Sampling frequency should be twice per month, with this initial approach modified as data is collected and reviewed.

- pH
- Total Dissolved Solids (TDS)
- Electrical Conductivity (EC<sub>w</sub>)
- Calcium
- Magnesium
- Sodium
- Carbonate
- Bicarbonate
- Sodium Adsorption Ratio (SAR)
- Adjusted Sodium Adsorption Ratio (adjSAR)
- Adjusted RNa
- Chloride
- Boron
- Total Nitrogen
- Nitrate-Nitrogen
- Ammonium-Nitrogen
- Phosphorus
- Potassium

It should be noted that the City does monitor some of these constituents as required by the NPDES and WDR permit. For additional data, refer to Appendix D – Table 2.4.

### **3.7 Market Assessment Findings and Conclusions**

Based on the assessment to date, the use of recycled water for urban irrigation and industrial cooling water and water sale are potential markets which conceptual recycled water projects should be evaluated. There are a number of agencies that are interested in the regions potential recycled water supply. The use of recycled water for local agricultural irrigation (in either MID or TID service areas) is limited due to a number of issues, the primary of which is the availability, reliability and low cost of irrigation water available to water users in both MID and TID. The SJRNWR is a potential opportunity for wetlands enhancement. Groundwater recharge projects do not appear feasible at this time due to treatment requirements and associated project costs.



## 4 Regulatory Setting

This section summarizes the regulatory setting of the Northern San Joaquin Valley Water Reclamation Project, including recycled water regulations and wastewater regulations. Recycled water regulations focus on California's Title 22 which specifies treatment and water quality requirements for production and use of recycled water. Wastewater treatment regulations focus existing and proposed requirements in NPDES permits and Waste Discharge Requirements (WDR's). The RWQCB is the responsible agency for issuing reclamation (recycling) requirements, WDR's and discharge permits.

This section is organized as follows:

- Recycled Water Regulations
- Wastewater Regulations

### 4.1 Recycled Water Regulations

In general, recycled water operations in California are governed by California Department of Health Services (DHS) regulations and guidelines. Current regulations are compiled in the publication *California Health Laws Related to Recycled Water* ("The Purple Book") updated in June 2001. The Purple Book consists of excerpts from the Health and Safety Code, Water Code, and Titles 22 and 17 of the California Code of Regulations (CCR). Draft regulations include Groundwater Recharge Reuse Draft Regulations, dated August 2002, and revised in July 2003.

Title 22, Division 4, Chapter 3, Article 1 of the CCR (Title 22) serves as the source for regulations relating to recycled water. Important definitions and recycled water use categories presented within Title 22 are discussed below.

#### 4.1.1 Disinfected Secondary - 2.2 Recycled Water

"Disinfected secondary - 2.2 recycled water" means recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed a most probable number (MPN) of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30-day period.

#### 4.1.2 Disinfected Secondary - 23 Recycled water

"Disinfected secondary - 23 recycled water" means recycled water that has been oxidized and disinfected so that the median concentration of total coliform bacteria in the disinfected effluent does not exceed an MPN of 23 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed, and the number of total coliform bacteria does not exceed an MPN of 240 per 100 milliliters in more than one sample in any 30-day period.

#### 4.1.3 Disinfected Tertiary Recycled Water

"Disinfected tertiary recycled water" means a filtered and subsequently disinfected wastewater that meets the following criteria:

1. The filtered wastewater has been disinfected by either:

- a. A chlorine disinfection process following filtration that provides a CT value (the product of total chlorine residual and modal contact time measured at the same point) of not less than 450 milligram-minutes per liter at all times with a modal contact time of at least 90 minutes, based on peak dry weather design flow; or
  - b. A disinfection process that, when combined with the filtration process, has been demonstrated to inactivate and/or remove 99.999 percent of the plaque-forming units of F-specific bacteriophage MS2, or polio virus in the wastewater. A virus that is at least as resistant to disinfection as polio virus may be used for purposes of the demonstration.
2. The median concentration of total coliform bacteria measured in the disinfected effluent does not exceed an MPN of 2.2 per 100 milliliters utilizing the bacteriological results of the last seven days for which analyses have been completed and the number of total coliform bacteria does not exceed an MPN of 23 per 100 milliliters in more than one sample in any 30-day period. No sample shall exceed an MPN of 240 total coliform bacteria per 100 milliliters.

#### **4.1.4 Filtered Wastewater**

"Filtered wastewater" means an oxidized wastewater that meets the criteria in subsection 1 or 2:

1. Has been coagulated and passed through natural undisturbed soils or a bed of filter media pursuant to the following:
  - a. At a rate that does not exceed 5 gallons per minute per square foot of surface area in mono, dual or mixed media gravity, upflow or pressure filtration systems, or does not exceed 2 gallons per minute per square foot of surface area in traveling bridge automatic backwash filters; and
  - b. So that the turbidity of the filtered wastewater does not exceed any of the following:
    - i) An average of 2 Nephelometric Turbidity Units (NTU) within a 24-hour period;
    - ii) 5 NTU more than 5 percent of the time within a 24-hour period; and
    - iii) 10 NTU at any time
2. Has been passed through a microfiltration, ultrafiltration, nanofiltration, or reverse osmosis membrane so that the turbidity of the filtered wastewater does not exceed any of the following:
  - a. 0.2 NTU more than 5 percent of the time within a 24-hour period; and
  - b. 0.5 NTU at any time.

#### **4.1.5 Uses of Recycled Water**

In the absence of any site-specific concern held by a local or state health or water quality officer, all uses as outlined below in Table 4-1 are permitted. The uses for recycled water outlined in Table 4-1 do not apply to the use of recycled water onsite at a water recycling plant, or wastewater treatment plant, provided access by the public to the area of onsite recycled water use is restricted. In all cases, there are restrictions on the application area as well as other requirements, including monitoring.

**Table 4-1: Recycled Water Uses Allowed in California**

Recycled Water Use	Treatment Level			
	Disinfected Tertiary Recycled Water	Disinfected Secondary-2.2 Recycled Water	Disinfected Secondary-23 Recycled Water	Undisinfected Secondary Recycled Water
<b>Irrigation</b>				
Food crops where recycled water contacts the edible portion of the crop, including all root crops	Allowed <sup>d</sup>	Not allowed	Not allowed	Not allowed
Parks and playgrounds	Allowed <sup>d</sup>	Not allowed	Not allowed	Not allowed
School yards	Allowed <sup>d</sup>	Not allowed	Not allowed	Not allowed
Residential landscaping	Allowed <sup>d</sup>	Not allowed	Not allowed	Not allowed
Unrestricted access golf courses	Allowed <sup>d</sup>	Not allowed	Not allowed	Not allowed
Any other irrigation uses not prohibited by other provisions of the California Code of Regulations	Allowed <sup>d</sup>	Not allowed	Not allowed	Not allowed
Food crops where edible portion is produced above ground and not contacted by recycled water	Allowed	Allowed	Not allowed	Not allowed
Cemeteries	Allowed	Allowed	Allowed	Not allowed
Freeway landscaping	Allowed	Allowed	Allowed	Not allowed
Restricted access golf courses	Allowed	Allowed	Allowed	Not allowed
Ornamental nursery stock and sod farms	Allowed	Allowed	Allowed	Not allowed
Pasture for milk animals	Allowed	Allowed	Allowed	Not allowed
Nonedible vegetation with access control to prevent use as a park, playground or school yard	Allowed	Allowed	Allowed	Not allowed
Orchards with no contact between edible portion and recycled water	Allowed	Allowed	Allowed	Allowed
Vineyards with no contact between edible portion and recycled water	Allowed	Allowed	Allowed	Allowed
Non food-bearing trees, including Christmas trees not irrigated less than 14 days before harvest	Allowed	Allowed	Allowed	Allowed
Fodder crops (e.g. alfalfa) and fiber crops (e.g. cotton)	Allowed	Allowed	Allowed	Allowed
Seed crops not eaten by humans	Allowed	Allowed	Allowed	Allowed
Food crops that undergo commercial pathogen-destroying processing before consumption by humans	Allowed	Allowed	Allowed	Allowed
Ornamental nursery stock, sod farms not irrigated less than 14 days before harvest	Allowed	Allowed	Allowed	Allowed
<b>Supply for Impoundment</b>				
Non-restricted recreational impoundments, with supplemental monitoring for pathogenic organisms	Allowed <sup>b</sup>	Not allowed	Not allowed	Not allowed
Restricted recreational impoundments and publicly accessible fish hatcheries	Allowed	Allowed	Not allowed	Not allowed
Landscape impoundments without decorative fountains	Allowed	Allowed	Allowed	Not allowed
<b>Supply for Cooling or Air Conditioning</b>				
Industrial or commercial cooling or air conditioning involving cooling tower, evaporative condenser, or spraying that creates a mist	Allowed <sup>e</sup>	Not allowed	Not allowed	Not allowed
Industrial or commercial cooling or air conditioning not involving a cooling tower, evaporative condenser, or spraying that creates a mist	Allowed	Allowed	Allowed	Not allowed
<b>Other Uses</b>				
Groundwater recharge	See Guidance Provided Below			
Flushing toilets and urinals	Allowed <sup>d</sup>	Not allowed	Not allowed	Not allowed

Recycled Water Use	Treatment Level			
	Disinfected Tertiary Recycled Water	Disinfected Secondary-2.2 Recycled Water	Disinfected Secondary-23 Recycled Water	Undisinfected Secondary Recycled Water
Priming drain traps	Allowed <sup>d</sup>	Not allowed	Not allowed	Not allowed
Industrial process water that may contact workers	Allowed <sup>d</sup>	Not allowed	Not allowed	Not allowed
Structural fire fighting	Allowed <sup>d</sup>	Not allowed	Not allowed	Not allowed
Decorative fountains	Allowed <sup>d</sup>	Not allowed	Not allowed	Not allowed
Commercial laundries	Allowed <sup>d</sup>	Not allowed	Not allowed	Not allowed
Consolidation of backfill material around potable water pipelines	Allowed <sup>d</sup>	Not allowed	Not allowed	Not allowed
Artificial snow making for commercial outdoor uses	Allowed <sup>d</sup>	Not allowed	Not allowed	Not allowed
Commercial car washes, including hand washes if the recycled water is not heated, where the general public is excluded from the washing process	Allowed <sup>d</sup>	Not allowed	Not allowed	Not allowed
Industrial boiler feed	Allowed	Allowed	Allowed	Not allowed
Nonstructural fire fighting	Allowed	Allowed	Allowed	Not allowed
Backfill consolidation around nonpotable piping	Allowed	Allowed	Allowed	Not allowed
Soil compaction	Allowed	Allowed	Allowed	Not allowed
Mixing concrete	Allowed	Allowed	Allowed	Not allowed
Dust control on roads and streets	Allowed	Allowed	Allowed	Not allowed
Cleaning roads, sidewalks and outdoor work areas	Allowed	Allowed	Allowed	Not allowed
Industrial process water that will not come into contact with workers	Allowed	Allowed	Allowed	Not allowed
Flushing sanitary sewers	Allowed	Allowed	Allowed	Allowed

Footnotes:

- Refer to the full text of the latest version of Title-22: California Water Recycling Criteria. This chart is only a guide to the June 2001 version. Summary updated from Water Reuse Association located online at <http://www.watereuse.org/Pages/usestable.html>
- With "conventional tertiary treatment." Additional monitoring for two years or more is necessary with direct filtration.
- Drift Eliminators and biocides are required if public or employees can be exposed to mist.
- Recycled water shall be a disinfected tertiary recycled water, except that for filtration pursuant to Section 60301.320(a) coagulation need not be used as part of the treatment process provided that the filter effluent turbidity does not exceed 2 NTU, the turbidity of the influent to the filters is continuously measured, the influent turbidity does not exceed 5 NTU for more than 15 minutes and never exceeds 10 NTU, and that there is the capability to automatically activate chemical addition or divert the wastewater should the filter influent turbidity exceed 5 NTU for more than 15 minutes

#### 4.1.6 CCR-Title 22 Revisions – Groundwater Recharge Reuse

DHS released Title 22, Division 4, Chapter 3 draft regulations addressing groundwater recharge reuse. The draft regulations represent the current thinking of DHS on recharge of groundwater with recycled water; however, they are not law. Table 4-2 summarizes the requirement of the draft regulation as of April 23, 2001. Note that this draft regulation was revised in July 2003.

**Table 4-2: Draft Requirements for Groundwater Recharge Reuse**

Constituent	Potential Regulation
Microorganisms	Water must be either filtered wastewater or disinfected tertiary recycled water. Treated wastewater must be retained underground for 6 to 9 months and shall not be extracted within 500 to 2,000 lateral feet from a point of recharge depending on application method.
Nitrogen	Nitrogen shall not exceed a given total as nitrogen. The value will probably range from 1 to 10 mg/L.
Regulated Contaminants	Recycled water must comply with the following: <ul style="list-style-type: none"><li>• Primary MCLs</li><li>• Action Level for lead</li><li>• Applicable water quality control objectives specified in Water Quality Control Plan established by the RWQCB</li><li>• Secondary MCLs for the constituents and characteristics in Tables 64449-A and B ("Upper" levels) in Chapter 15<sup>a</sup>.</li><li>• Recycled water shall not exceed any public health goal (PHG) for a contaminant, or the level of the contaminant in the receiving groundwater, whichever is higher, unless approved by the Department.</li></ul>
Total Organic Carbon (TOC)	Filtered wastewater shall not exceed 16 mg/L TOC. Recycled water TOC shall be less than 1 mg/L divided by the maximum average recycled water contribution (RWC) specified by the Department or be treated by reverse osmosis to do so. For a PGRRP using direct injection, the entire wastewater stream shall be treated with reverse osmosis.

Footnotes:

a. Refers to California Code of Regulations Title 22, Division 4, Chapter 15.

Mr. Robert Hultquist of the DHS Drinking Water Program voiced significant proposed updates to the groundwater recharge reuse guidelines at the June 2003 WaterReuse Foundation Research Conference. Principal of these was that DHS seeks to change the treatment performance standard to (0.5 mg/L TOC)/RWC and establish a treatment goal of (0.3 mg/L TOC)/RWC for unregulated chemical control, with TOC as a surrogate. RWC is the fraction of Reclaimed Water Contribution to total water used for indirect potable reuse projects. For more information on this topic, refer to the DHS website at <http://www.dhs.ca.gov/ps/ddwem/>.

#### **4.1.7 Implementation of Water Recycling Projects**

Implementation of a recycled water project requires submission of a Title 22 Engineers Report to the RWQCB and DHS. The purpose of the Engineers Report is to ensure that the project is planned and designed consistent with State Regulations and in accordance with recycled water criteria for production, distribution, and reuse. Approval of recycled water projects varies between the RWQCBs. In the RWQCB Central Valley Region, it is expected that a recycled water project would be permitted under the WDR's or NPDES permit. The requirements or permit may incorporate quality, treatment, use, reliability, and monitoring requirements.

### **4.2 Wastewater Regulation**

Existing NPDES permits and WDR's (i.e. land discharge requirements) issued by the RWQCB provide a perspective on current regulatory conditions. Wastewater discharge requirements continue to become more stringent as the State continues to investigate and regulate more contaminants and the body of research on constituents expands. Contaminants of special interest are those whose likelihood of introduction through body contact recreation and edible food ingestion pathways are highest.

Discharge requirements are expected to become more stringent due to 1) tightening of Water Quality Control Plan (Basin Plan) water quality objectives by the RWQCB (eg, for salinity), 2) the implementation of the California Toxics Rule (CTR) through the State's Implementation Plan (SIP), and 3) total maximum daily load (TMDL) requirements for surface waters. Section 303(d) of the Clean Water Act requires the identification of water bodies that do not meet, or are not expected to meet, water quality standards, or are considered impaired. The affected water body, and associated pollutant or stressor, is then prioritized in the 303(d) list. The Clean Water Act further requires the development of a Total Maximum Daily Load (TMDL) for each listing.

The sections that follow present summaries of the City of Modesto and other potential stakeholders' NPDES permits and WDR's, identifying limits on important wastewater constituents, as well as studies required in the permits that foretell future regulatory trends. Summaries of recent conversations with RWQCB staff are also provided in Section 4.2.3. For more details on the wastewater regulatory setting refer to Appendix C.

#### 4.2.1 NPDES Permits for Surface Discharge

The Cities of Modesto, Turlock, Manteca/Lanthrop are the municipal agencies in the San Joaquin region with NPDES permits for discharge (of treated municipal wastewater) to the surface waters of the lower San Joaquin River upstream of Stockton, Old River and the Bay Delta. This section summarizes the NPDES permit water quality requirements for the three WWTP's whose discharge environments are similar.

Table 4-3 summarizes the City of Modesto NPDES permit requirements for discharge of secondary effluent to the San Joaquin River, which is restricted to the months of October 1 through May 31. Table 4-4 lists studies and reports required under the NPDES permit.

**Table 4-3: Current City of Modesto NPDES Permit Flow and Water Quality Requirements**

Water Quality Parameter	Comment
Design Flow	62.5 mgd Primary and 70 mgd Secondary
Biochemical Oxygen Demand (BOD)	30 mg/l (monthly average)
Total Suspended Solids (TSS)	45 mg/l (monthly average)
Settleable Solids	0.1 ml/l (monthly average)
Ammonia (as N)	Varies according to pH. (refer to attachment D of NPDES permit)
Chlorine Residual	0.019 mg/l (daily max)
Total Coliform	23 MPN/100ml
Selenium	4.1 µg/l (monthly average)
Copper	4.5 µg/l (monthly average)
Molybdenum	10 µg/l (monthly average)
PH	Between 6.5 and 8.5.
Total Dissolved Solids (TDS)	924 mg/l (daily maximum)
EC	1,689 µmhos/cm
Bromodichloromethane	137.5 µg/l (daily maximum)
Dibromochloromethane	70 µg/l (daily maximum)
Dissolved Oxygen (DO)	Prevent receiving water's ambient DO to decrease by more than 0.5 mg/l.
Dilution Requirement	20:1 (Effluent:San Joaquin River Flow)

**Table 4-4: Current City of Modesto NPDES Permit Required Studies**

Required Study/Report/Plan	Comment/Coverage
Pollutant Data Collection Report	Priority Pollutants (Completed 3/3/03)
Dilution/Mixing Zone Study	Aluminum, Ammonia, Chlorine, Bromo-dichloromethane, Dibromochloromethane
Pollution Prevention Plans	Selenium, Copper, Molybdenum, Salinity, Mercury, Trihalomethanes
Dissolved Oxygen Study	Assess potential impacts of WW discharge on Dissolved Oxygen concentrations in lower San Joaquin River and Delta.
Salt Study	(Completed 7/12/02)

Table 4-5 summarizes NPDES permit requirements for the Cities of Turlock and Manteca/Lathrop for discharge of wastewater treatment plant effluent to the Harding Drain and San Joaquin River, respectively. Table 4-6 lists studies and reports required under the NPDES permits for the Cities of Turlock and Manteca/Lathrop. Mass loading limits are included for BOD, TSS, TDS, iron, manganese, and molybdenum in the permit for Turlock. Turlock is upgrading to tertiary treatment to comply with its NPDES permit and is extending its effluent pipeline directly to the San Joaquin River, to cease discharge to the Harding Drain (tributary to the San Joaquin River), per DHS recommendations to the RWQCB outlined in a July 2000 letter. The Manteca permit expressly requires wastewater discharged to the San Joaquin River to be oxidized, coagulated, filtered, and disinfected in accordance with Title 22 Regulation by August 2006.

**Table 4-5: Current NPDES Permit Flow and Water Quality Requirements for Turlock and Manteca/Lathrop**

Water Quality Parameter	City of Turlock	Cities of Manteca/Lathrop <sup>b</sup>
Design Flow (mgd)	20	9.87 (dry weather) Future
BOD <sup>a</sup> (mg/l)	10	10
Total Suspended Solids <sup>a</sup> (TSS)	10	10
Settleable Solids <sup>a</sup> (ml/l)	0.1	0.1
Total Coliform (MPN/100ml)	2.2 (monthly median)	2.2 (weekly median)
Oil and Grease <sup>a</sup> (mg/l)	10	10
Chlorine Residual (mg/l)	0.011(4-hr avg) 0.019 (1-hr avg)	0.02 (1-hr avg), 0.01 (4-day avg)
DO (mg/l)	5 (by 2002), 7.5 (by 2006)	1
PH	6.5-8.5	6.5-8.0
TDS <sup>a</sup> (mg/l)	690	-
EC <sup>a</sup> (umhos/cm)	1100	700 (Apr. to Aug.) 1,000 (Sept. to Mar.)
Ammonia <sup>a</sup> (as N)(mg/l)	13.1	2.1 (June to Sept.) 2.8 (Oct. to May)
Nitrate (as N) (mg/l)	-	10
Nitrite (as N) (mg/l)	-	1
Iron <sup>a</sup> (ug/l)	300	300
Manganese <sup>a</sup> (ug/l)	50	50
Molybdenum <sup>a</sup> (ug/l)	10	-
Arsenic <sup>a</sup> (ug/l)	-	8.9
Copper <sup>a</sup> (ug/l)	4.5	7.9
Cyanide <sup>a</sup> (ug/l)	4.25	3.7
Iron <sup>a</sup> (ug/l)	-	300
Manganese <sup>a</sup> (ug/l)	-	50
Methylene blue active substances (MBAS)		500
Zinc <sup>a</sup> (ug/l)	31.5	-
Bromodichloromethane <sup>a</sup> (ug/l)	0.56	5
Aluminum <sup>a</sup> (ug/l)	87	71
Tributyltin <sup>a</sup> (ug/l)	0.063	-

Footnotes:

a. Monthly average requirement.

b. Effluent limits to the San Joaquin River. Requirements shown are for limits that go into effect in August 2006.

**Table 4-6: Current NPDES Permit Required Studies for Turlock and Manteca/Lathrop**

Required Study/Report/Plan	City of Turlock	Cities of Manteca/Lathrop
Pollutant Study	Group A pesticides, chlorpyrifos, diazinon, DDT, boron, nitrates, and selenium.	Pollution Prevention Plan, SIP Study Dioxins, Toxicity Reduction Evaluation
Mercury Source Identification Plan	Sacramento- San Joaquin Delta 303(d), Monitoring Program Study	None
Progress Reports	Copper, zinc, DO	Groundwater Monitoring
Receiving Water studies	Harding Drain, SJR	Thermal discharge study
Dissolved Salts Study	EC and TDS	None
Various	None	Title 22 Engineer's Report, Sanitary Sewer System Plan

#### **4.2.2 Waste Discharge Requirements (Land Discharge)**

Most of the WWTP's in the regions dispose of treated wastewater through land disposal or reclamation (i.e. percolation ponds, evaporation ponds, and some crop irrigation). Table 4-7 is a comparative summary of regulatory limits and required studies for the City of Modesto and other cities, based on WDR permit requirements. Table 4-7 lists the studies and reports required under the WDR permits.

Table 4-7: Summary of WDR Permit Requirements for Modesto/Other Stakeholders

City and (Reviewed Permit Date)	Application Rate Limit or Avg Appl. Rate	Maximum Loading Rates						Required Studies	Comment
		BOD (lb/AC/day) 30-day avg.	BOD (mg/l) 30-day avg.	TSS (mg/l) 30-day avg.	SS (mL/l) 30-day avg.	TDS (mg/l) 30-day avg.	EC (umhos/cm) 30-day avg.		
Modesto (1999)	19.6 mgd	Cannery Segregation: 150. Secondary WW: 50.						Groundwater (GW) and surface water salt study. Other studies documented in Table 4-4.	1.0 mg/l min DO required for all ponds. Increase in total coliforms (GW) shall not exceed MPN of 2.2/100 ml over 7 days.
Patterson (2000) and *Apr 2003 Letter	1.3 mgd w/ AIPS and 80 AC per/cap ponds) plan to expand to 3.15 mgd 2000 ADWF 0.854 mgd, 1.0 mgd dsgrn.	Activated sludge/AI PS to ponds (30/45), *20		*20	Activated sludge/AI PS to ponds (0.5/ 1.0 Daily Max)			GW wells/ monitoring required. Salinity Impact Study. Study to determine impacts of past/current WW discharges on GW. Potential salt reduction workplan. Solids Management Plan.	Must minimize GW impacts. 1.0 mg/l min DO in upper 1 foot of WW ponds. Total coliforms in GW shall not exceed MPN of 2.2/100 ml over 7 days. Ave. EC high (1800 and 1250 umhos/cm resp., in GW and munic. water supply. *Shortcomings of AIPS nitrate removal noted. SR may be responsible for poor GW, but discharge appears to be increasing nitrate, organic carbon, and salt in GW. RWQCB requires justification for a liner for AIPS ponds, and cost estimates for dewatering or containment of sludge ponds.
Oakdale (2001)	1.3 to 3.1 mgd flow (2.4 mgd dsgrn). Limited to avg. daily influent of 2.4 mgd.	30		30		450	10	Water Balance and Capacity Calculation Report needs to be submitted. GW monitoring req'd (330-610 umhos/cm range) More wells needed. Interim Sewer System Spill Prevention, Control and Cleanup Plan, Sewer Condition Assessment and Retrofit Workplan Phase I Improvements Status Report.	RWQCB concerned with deposition in perc. ponds. Have not been able to maintain required 1.0 mg/l min DO in upper 1 foot of WW ponds. WT 6-8' below perc. ponds. Need to implement Best Practicable Control Technology to minimize salinity of discharge.
Riverbank (1994)	1.3 mgd WW and 4.0 mgd cannery waste (July-Oct)								1.0 mg/l min DO in upper 1 foot of WW ponds. Total coliforms in GW shall not exceed MPN of 2.2/100 ml over 7 days. GW must meet MCLs specified in 22 CCR, Div 4, Ch 15.
Waterford (1994)	0.502 mgd (1.0 mgd dsgrn)								1.0 mg/l minimum dissolved oxygen of upper 1 foot of WW ponds. Total coliforms in GW shall not exceed MPN of 2.2/100 ml over 7 days.
Hughson (2000)	2.33 mgd design	40		40	0.2 daily max	450	10	GW monitoring required. GW report required.	DO for WW ponds shall not fall below 1.0 mg/l. Ice cream operation needs pretreatment.
Delhi (1996)	0.4 mgd as of 1996 (1.0 mgd expected)	40		40	0.2	0.2		GW monitoring required. GW report required.	1.0 mg/l min DO in upper 1 foot of WW ponds.
Ripon (1994)	2.34 mgd							GW monitoring required. GW assessment report required.	DO for WW ponds shall not fall below 1.0 mg/l. Ice cream operation needs pretreatment.
Salida (1992)	1.2 mgd								1.0 mg/l min DO in upper 1 foot of WW ponds. Nestle site undergoing GW cleanup.
Manteca/Lathrop (1995)	5.3 mgd								After SBR treatment, discharges to adjacent, privately owned orchards (peaches, almonds, and walnuts). 1.0 mg/l min DO in upper 1 foot of holding ponds.
Turlock (1999)	10.3 mgd ADWF								Minimum of primary effluent quality for non-food crops. 1.0 mg/l min DO in holding ponds. Must keep waste within disposal site.
									Divers up to 7.9 mgd secondary effluent to private dairy. Emergency storage basin limited to 1.0 mg/l min DO in upper 1 foot. Total coliforms in GW shall not exceed MPN of 2.2/100 ml over 7 days.

#### **4.2.3 Regional Board Commentary on NPDES/WDR Permits**

RMC/Black & Veatch and the City of Modesto held conversations with RWQCB staff on May 19 and June 5, 2003 to discuss the RWQCB perspective on WWTP regionalization and recycled water. The May 19 discussion focused on surface discharge, while the June 5 session focused on land discharge. Combined highlights of the discussions follow.

##### **4.2.3.1 General Commentary on Constituents of Concern and Discharge Limitations**

According to RWQCB staff, the California Toxics Rule (CTR) is supposed to be implemented in 5 years. The application of the CTR and State Implementation Plan (SIP) are driving Regional Board staff to look at all discharge permits critically. Given recent experience and guidance, the highest priority constituents of concern are salts and THMs (byproducts of chlorine disinfection). Temperature is also critical for effluent dominated waterways (EDWs). Based upon recent experience with State and Regional Board, including the recent Vacaville (EDW) case, Board staff highlighted the inadequacy of the Basin Plan amendment approach which has been challenged legally. Board staff also mentioned recent proposed TMDL information it received on salinity, which allocates salt loading to San Joaquin River discharges in the "upper San Joaquin River area" (Turlock and Modesto) to approximately 2,000 tons/month. The salinity TMDL is expected to be finalized within two years. According to Board staff, this would seem to handle current discharge flows at current quality levels, but does not account for growth. Regarding future discharge restrictions, Board Staff did not see any major changes on the horizon.

##### **4.2.3.2 Overall View of River Discharge by Modesto and Neighboring Communities**

The Regional Board does not currently view seasonal discharge of high quality wastewater at 20:1 dilution rate as a benefit to the River. [In fact, the reviewed Modesto and Manteca NPDES permits state directly: "The Discharger shall maximize discharge to land all year."] An example of this non-benefit view given by the Board staff was the City of Jackson, which discharges tertiary effluent in excess of 5% (less than 20:1 dilution) to a creek in summertime, and has drawn attention of DHS because of potential impacts to identified beneficial uses of the creek that feeds into Lake Amador.

River discharge would be a benefit if the discharge were to occur during low flow periods and during droughts (minimum flow releases), but the DHS would have to change its view of their protective dilution requirements for this to happen, and/or recycled water would need to be highly treated (i.e. reverse osmosis). Also, the RWQCB has not expressed interest to date in the possible benefit of wetlands upstream of discharge. The City of Brentwood is a good example of a case where regulatory constraints (having to meet standards at the tail end of a wetland in water degraded by natural sources) make wetlands treatment difficult to implement due to high cost.

##### **4.2.3.3 Regional Board Perspective of Land Versus Surface Discharge**

Current RWQCB policy does favor land discharge over river discharge. Attendees at the May 19 meeting see the Regional Board "picking off the surface water discharges one by one". The salinity objective in the Delta (approximately 450 mg/l TDS) drives both surface water discharge restrictions and land discharge restrictions. RWQCB staff felt it would take a decade for the impact of this approach to fully impact the land dischargers. RWQCB staff is cautious, however, noting there would be a long-term problem with land discharge because of the impacts to groundwater, especially in those places with high groundwater table (the ultimate goal is to prevent degradation of groundwater, using best practical technology). Both crop yield and impacts on groundwater should be considered. This is becoming apparent in places like Ceres, where crops are being killed by high groundwater elevations. RWQCB staff also highlighted the need to prevent runoff of treated wastewater from land application sites.

Board staff concurred that recycled water production is preferred over land discharge, due to its higher quality and potential for beneficial reuse. Board staff felt it is even better than the "dedicated land application programs with water applied at agronomic rates, such as at the Modesto Jennings Road facility/ranch", because there will still be potential for salt buildup at such sites. Regional Board staff views the Modesto Salt Study as helping to establish a "baseline" for assessing future impacts, and acknowledged that more land will likely be required for such land-based systems in the future.

#### **4.2.3.4 Potential Beneficiaries of Regionalization of WW Treatment and Disposal**

RWQCB land discharge staff listed Hilmar as an area that would benefit from improved wastewater treatment. The Hilmar Cheese Company located there is a candidate as a potential discharger to a regional plant. Ceres appears to have an inadequate treatment system discharging to high groundwater (GW). Land management staff is in favor of a regionalized facility, citing how Stanislaus County has regularly permitted the proliferation of onsite systems permitted in small independent communities (e.g. west of Riverbank). Furthermore, high GW tables geographically challenge certain communities, especially those close to the San Joaquin, Stanislaus, and Tuolumne Rivers. Ceres has pressing plant and land disposal capacity issues, and is planning to construct an outfall line to the City of Turlock to accommodate current flow in excess of capacity and anticipated growth. Westley and Grayson are other small housing authorities that need help with wastewater disposal. RWQCB staff identified Patterson as an area also having GW problems. The Board is also concerned about potential GW impacts from wastewater operations (percolation ponds) in Oakdale and Riverbank.

#### **4.2.3.5 Potential Beneficiaries of Regional Water Recycling**

In general, RWQCB land discharge staff views recycling favorably, since recycling provides beneficial reuse and discharge of higher quality water to GW compared to secondary effluent through percolation ponds. Board staff cited salt impacts to groundwater as a main issue if water were land applied and/or used for irrigation. Generally background salinity levels in surface water are better the farther upstream you go. The existence of high GW tables drives higher levels of treatment necessary for land application. Elsewhere in the Central Valley, RWQCB staff cited Clovis' desire for its own wastewater treatment plant, with recycling of water and discharge to irrigation canals in the winter as potentially impacting Fresno's water supply.

#### **4.2.4 Implementation of a Regional Wastewater Treatment Project**

Implementation of a regional wastewater treatment project would require submission of a Report of Waste Discharge to the RWQCB. The data and information in the report would be used to develop a new or amend the existing permit(s) or requirements (NPDES and/or WDR). Prior to submission of the report, compliance with the California Environmental Quality Act (CEQA) should be completed.

## 5 Conceptual Alternatives

This section identifies and develops potential alternatives for the Northern San Joaquin Valley Water Reclamation Project. Four conceptual alternatives plus a Baseline Alternative were identified and developed for the Project. The four conceptual alternatives were developed through meetings and coordination with the City of Modesto staff and stakeholders. The four conceptual alternatives consider the results of the market assessment, regulatory requirements, and stakeholder workshops and are thought to represent the best options for implementation of a recycled water project.

It should be noted that these alternatives are representative of the types of projects that could be implemented and are not intended to meet all the goals and future needs. This set of four alternatives make up a toolbox of options that can be combined to form an overall recycled water project that meets future needs and goals.

The regional aspect of this project also lead to an assessment of wastewater conveyance options from stakeholder WWTP's to the City of Modesto WWTP's. The purpose of the conveyance options was to develop a level of magnitude cost estimate that stakeholders could use as a comparison to continued operation of their WWTP's. Unit cost estimates for various treatment processes were developed to 1) assist stakeholders in evaluation of satellite treatment options or WWTP upgrades and 2) summarize the basis of treatment costs for the recycled water conceptual alternatives. The unit cost estimates are summarized in Appendix E and have not been included in this section.

This section is organized as follows:

- Summary of Stakeholder Participation
- Wastewater Conveyance Alternatives
- Modesto Only/No Recycled Water Project Alternative (Baseline Alternative)
- Recycled Water at the Primary Treatment Plant Alternative
- Satellite Treatment Facilities Alternatives (Similar concept could work for facilities at Oakdale, Patterson, or Hughson)
- Water Sale to an Irrigation District
- Satellite RW (Beard Industrial Area) and Joint Cogeneration Project
- Potential Alternative Benefits
- Alternative Assessment

Estimated costs in this section were developed based on unit costs that are documented in Appendix E. Estimated cost can be referenced to summer 2003 Construction Cost Index (CCI) values. Annualized capital costs were calculated assuming a recovery period of 30 years and an interest rate of 6%. A construction contingency of 50% and engineering, legal, administrative, and environmental contingency of 30% were applied to the construction cost estimates. These high cost multipliers were appropriate due to the preliminary nature of this feasibility study. Environmental constraints, retrofit needs, geotechnical considerations, and other factors have not been evaluated or taken into consideration.

The following sections are primarily from the Identify and Develop Alternatives TM in Appendix E. The reader is referred to this TM for additional details on stakeholders, treatment cost estimates, and other details that have not been included in this section for purposes of conciseness.

## 5.1 Summary of Stakeholder Participation

The City of Modesto held stakeholder workshops on April 9 and September 9, 2003 to identify potential stakeholders and discuss conceptual alternatives for the regional wastewater recycling facility. Survey questions were distributed to participants and collected by the City. Based on participation in the stakeholder meetings and survey results, the Cities of Ripon, Salida, Escalon, Patterson, Ceres, Turlock, and Manteca expressed potential interest in the project.

Oakdale, Riverbank<sup>1</sup>, Grayson, Westley, Hughson, and Waterford<sup>2</sup> did not engage the process or express interest in the project; however these cities are located in the vicinity of Modesto and may have interest in the future. Hilmar expressly stated they did not have interest in the project. Table 5-1 represents a compilation of stakeholder interest or motivation to join in a potential regionalized wastewater facility, as identified through participation in the stakeholder workshops and completion of stakeholder questionnaires.

**Table 5-1: Summary of Stakeholders Potential Interest in Regionalized Project**

Stakeholder	Wastewater Treatment Needs	Wastewater (WW) Disposal Needs	Long-Term WW Disposal Needs	Recycled Water Supply
Ripon		✓	✓	
Salida		✓	✓	
Oakdale	No Response (NR)	NR	NR	NR
Riverbank	NR	NR	NR	NR
Escalon	✓	✓	✓	
Patterson	✓	✓	✓	
Grayson	NR	NR	NR	NR
Westley	NR	NR	NR	NR
Hughson	NR	NR	NR	NR
Waterford	NR	NR	NR	NR
Ceres	✓	✓	✓	✓
Turlock	✓	✓	✓	
Manteca	✓	✓	✓	✓

Turlock, Ceres, and Manteca appear less likely candidates in the near-term as they are proceeding with treatment upgrades at their WWTP. However, these stakeholders have acknowledged their interest in long-term, regional solutions, particularly as they relate to disposal. Further, these entities believe that long-term disposal may be best accomplished through recycling as opposed to continued disposal practices.

## 5.2 Wastewater Conveyance Alternatives

The creation of building blocks for evaluating raw wastewater conveyance assumed that the most feasible alternatives would collect wastewater from several plants within a common geographic area and send combined flows to the closer of two City of Modesto wastewater facilities. To that end, the following groupings of stakeholders and destinations in the Modesto system were explored:

- Ripon and Salida (to Primary)

<sup>1</sup> A representative of Riverbank participated in the first stakeholder workshop but did not attend the second workshop.

<sup>2</sup> A representative of Waterford participated in the first stakeholder workshop but did not attend the second workshop.

- Oakdale, Riverbank, and Escalon (to Primary)
- Waterford and Hughson (to Primary)
- Patterson (to Secondary)
- Grayson and Westley (to Secondary)

It is recognized that raw wastewater conveyance is not the only option that stakeholders are interested in. Stakeholders are also interested in continuing existing treatment and conveying secondary or tertiary treated wastewater to a regional treatment plant. However, for this feasibility study, the conveyance option was assumed to be conveyance of raw wastewater.

Table 5-2 lists the preliminary design criteria that were used to conceptually design the conveyance and distribution pipelines. The criteria was used in conjunction with existing wastewater flow data and future projections to develop pump station sizes and pipeline sizes.

**Table 5-2: Preliminary Pipeline Design Criteria**

Element	Unit	Design Criteria
Distribution Delivery Pressure	Pounds per square inch (Psi)	60
Max Flow Velocity	ft/sec	5
'C' Value	-	120

Table 5-3 lists preliminary capital and Operation and Maintenance (O&M) unit costs for conveyance and distribution.

**Table 5-3: Conveyance and Distribution Unit Cost**

Element	Unit	Unit Cost
<b>Capital Cost</b>		
Pipeline	Per inch per linear foot	\$10
Bore and Jack Crossing	Per inch per linear foot	\$20
Microtunneling	Per inch per linear foot	\$25
Pump Stations	Per hp	\$3,000
Right of Way	Per acre	\$8,500
Appurtenances	Percent of Pipeline Construction Cost	10
Construction Contingency	Percent of Total Construction Cost	50
Engineering, Legal, Admin, Environmental	Percent of Total Cost, including Contingency	30
<b>Annual O&amp;M Costs</b>		
Pipelines	% of Construction Cost	1.0
Pump Station	Per Flow Rate (mgd): 20, 8, 5, 2, 1	\$149,000, \$92,000, \$78,000, \$60,000, \$55,000

Conveyance pipeline lengths were determined graphically and are presented in Figure 5-1. Pipelines were routed along existing roads between the cities and the treatment plants. The wastewater conveyance evaluation only investigated the one alignment option for each group of stakeholders. Additional evaluations will need to be completed in the next phase to investigate other alignments, stakeholder groupings, and refined wastewater flow criteria. The goal of the evaluation for this study was to define an order of magnitude cost estimate that could be used to assess the potential of conveying raw wastewater. Environmental constraints have not been considered for the alignments and will need to be assessed in the next phase of the project.

**Figure 5-1: Potential Wastewater Conveyance Pipelines**

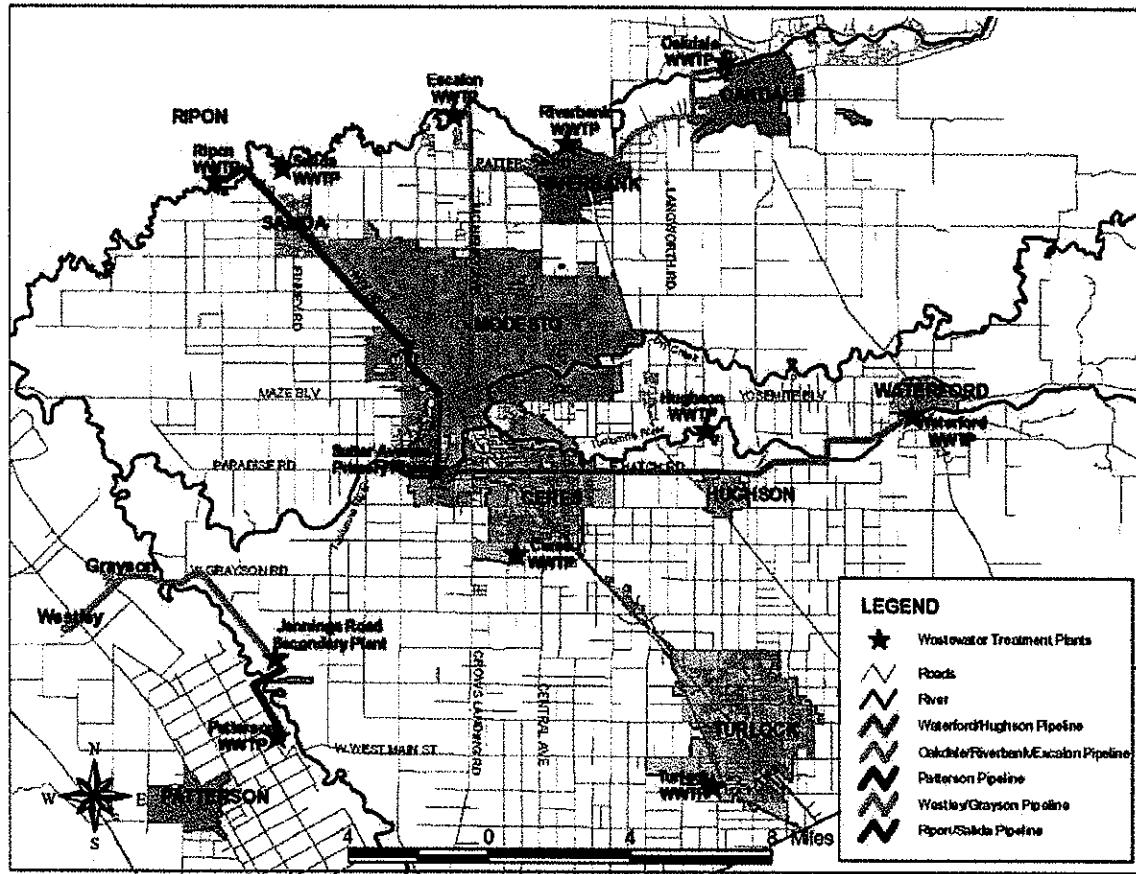


Table 5-4 through 5-8 presents the estimated costs for the raw wastewater conveyance alignments that were evaluated.

**Table 5-4: Estimated Cost of Conveyance Options: Ripon and Salida (11.6 mi of Pipeline)**

Element	Estimated Cost	
	Existing Flow	Flow at 2025 (4% growth)
Pipelines	\$8,131,000	\$11,584,000
Crossing	\$50,000	\$70,000
Appurtenances	\$818,000	\$1,165,000
Pump Station	\$274,000	\$481,000
<b>Raw Construction Costs</b>	<b>\$9,273,000</b>	<b>\$13,300,000</b>
Construction Contingency (50%)	\$4,637,000	\$6,650,000
<b>Total Construction Cost</b>	<b>\$13,910,000</b>	<b>\$19,950,000</b>
Right of Way	\$45,000	\$48,000
Engr, Legal, Admin, and Environmental (30%)	\$4,187,000	\$5,999,000
<b>Total Capital Cost</b>	<b>\$18,142,000</b>	<b>\$25,997,000</b>
Annualized Capital	\$1,318,000	\$1,889,000
Annual O&M Piping	\$139,000	\$200,000
Annual O&M Pumping	\$63,000	\$78,000
<b>Total Annualized Cost</b>	<b>\$1,520,000</b>	<b>\$2,167,000</b>
<b>Total Annualized Cost/MGD</b>	<b>\$460,600</b>	<b>\$433,400</b>

**Table 5-5: Estimated Cost of Conveyance Options: Oakdale, Riverbank, and Escalon (21.3 mi of Pipeline)**

Element	Estimated Cost	
	Existing Flow	Flow at 2025 (4% growth)
Pipelines	\$17,530,000	\$23,760,000
Crossing	\$284,000	\$404,000
Appurtenances	\$1,781,000	\$2,416,000
Pump Station	\$718,000	\$1,024,000
<b>Raw Construction Costs</b>	<b>\$20,313,000</b>	<b>\$27,604,000</b>
Construction Contingency (50%)	\$10,157,000	\$13,802,000
<b>Total Construction Cost</b>	<b>\$30,470,000</b>	<b>\$41,406,000</b>
Right of Way	\$84,000	\$90,000
Engr, Legal, Admin, and Environmental (30%)	\$9,166,000	\$12,449,000
<b>Total Capital Cost</b>	<b>\$39,720,000</b>	<b>\$53,945,000</b>
Annualized Capital	\$2,886,000	\$3,919,000
Annual O&M Piping	\$305,000	\$414,000
Annual O&M Pumping	\$75,000	\$104,000
<b>Total Annualized Cost</b>	<b>\$3,266,000</b>	<b>\$4,437,000</b>
<b>Total Annualized Cost/MGD</b>	<b>\$725,800</b>	<b>\$443,700</b>

**Table 5-6: Estimated Cost of Conveyance Options: Waterford and Hughson (14.5 mi of Pipeline)**

Element	Estimated Cost	
	Existing Flow	Flow at 2025 (4% growth)
Pipelines	\$6,991,000	\$9,388,000
Crossing	\$86,000	\$118,000
Appurtenances	\$708,000	\$951,000
Pump Station	\$92,000	\$193,000
<b>Raw Construction Costs</b>	<b>\$7,877,000</b>	<b>\$10,650,000</b>
Construction Contingency (50%)	\$3,939,000	\$5,325,000
<b>Total Construction Cost</b>	<b>\$11,816,000</b>	<b>\$15,975,000</b>
Right of Way	\$53,000	\$55,000
Engr, Legal, Admin, and Environmental (30%)	\$3,561,000	\$4,809,000
<b>Total Capital Cost</b>	<b>\$15,430,000</b>	<b>\$20,839,000</b>
Annualized Capital	\$1,121,000	\$1,514,000
Annual O&M Piping	\$118,000	\$160,000
Annual O&M Pumping	\$55,000	\$60,000
<b>Total Annualized Cost</b>	<b>\$1,294,000</b>	<b>\$1,734,000</b>
<b>Total Annualized Cost/MGD</b>	<b>\$1,362,100</b>	<b>\$825,700</b>

**Table 5-7: Estimated Cost of Conveyance Options: Patterson (2.5 mi of Pipeline)**

Element	Estimated Cost	
	Existing Flow	Flow at 2025 (4% growth)
Pipelines	\$1,320,000	\$1,980,000
Crossing	\$0	\$0
Appurtenances	\$132,000	\$198,000
Pump Station	\$20,000	\$29,000
<b>Raw Construction Costs</b>	<b>\$1,472,000</b>	<b>\$2,207,000</b>
Construction Contingency (50%)	\$736,000	\$1,104,000
<b>Total Construction Cost</b>	<b>\$2,208,000</b>	<b>\$3,311,000</b>
Right of Way	\$9,000	\$10,000
Engr, Legal, Admin, and Environmental (30%)	\$665,000	\$996,000
<b>Total Capital Cost</b>	<b>\$2,882,000</b>	<b>\$4,317,000</b>
Annualized Capital	\$209,000	\$314,000
Annual O&M Piping	\$22,000	\$33,000
Annual O&M Pumping	\$55,000	\$60,000
<b>Total Annualized Cost</b>	<b>\$286,000</b>	<b>\$407,000</b>
<b>Total Annualized Cost/MGD</b>	<b>\$336,500</b>	<b>\$214,200</b>

**Table 5-8: Estimated Cost of Conveyance Options: Grayson, Westley (7.6 mi of Pipeline)**

Element	Estimated Cost	
	Existing Flow	Flow at 2025 (4% growth)
Pipelines	\$2,207,000	\$3,010,000
Crossing	\$30,000	\$40,000
Appurtenances	\$224,000	\$305,000
Pump Station	\$9,000	\$18,000
<b>Raw Construction Costs</b>	<b>\$2,470,000</b>	<b>\$3,373,000</b>
Construction Contingency (50%)	\$1,235,000	\$1,687,000
<b>Total Construction Cost</b>	<b>\$3,705,000</b>	<b>\$5,060,000</b>
Right of Way	\$27,000	\$28,000
Engr, Legal, Admin, and Environmental (30%)	\$1,120,000	\$1,526,000
<b>Total Capital Cost</b>	<b>\$4,852,000</b>	<b>\$6,614,000</b>
Annualized Capital	\$352,000	\$481,000
Annual O&M Piping	\$37,000	\$51,000
Annual O&M Pumping	\$11,000	\$22,000
<b>Total Annualized Cost</b>	<b>\$400,000</b>	<b>\$554,000</b>
<b>Total Annualized Cost/MGD</b>	<b>\$2,000,000</b>	<b>\$1,385,000</b>

### 5.3 Modesto Only/No Recycled Water Project Alternative (Baseline Alternative)

The Modesto Only/No Recycled Water Project Alternative is considered the baseline project and is used to assess the future treatment and disposal options that would likely be undertaken by the City of Modesto if a recycled water project were not implemented. The alternative also provides the basis for cost comparison and lays out the anticipated treatment requirements if no regionalized wastewater facility project were undertaken. The estimated cost of this baseline alternative is also used to assess the treatment and disposal benefit associated with each of the recycled water projects. This is further described in Section 5.8. Specific assumptions for this alternative are as follows:

- Assume 10 mgd Dissolved Air Floation (DAF)/solids handling implemented at the Secondary Treatment Plant to meet existing disposal requirements. This will increase the disposal capacity to the San Joaquin River in October and November.
- Assume steady 4% population growth to evaluate future needs. Future flow is estimated to be 56 MGD in 2025, requiring 34,200 AFY of additional disposal capacity.
- Expansion of City Ranch irrigation is assumed for increased disposal capacity in the future. Assume 224 acres/mgd required, at a cost of \$8,500/acre including development.
- Assume a future regulatory driver of 450 mg/l TDS for land application and surface discharge. Therefore microfiltration and reverse osmosis facilities are needed to treat a portion of the flow (25 MGD) to meet this requirement based on current effluent salinity. Brine disposal consists of evaporation ponds (41.4 acres land purchase/mgd RO) and landfill. This is a likely potential cost risk in the future for continued wastewater disposal.

Figure 5-2 shows the envisioned treatment schematic that may be required for future disposal if no recycled water project is implemented, based on the outlined assumptions.

**Figure 5-2: Baseline Alternative Schematic (Impact associated with no project)**

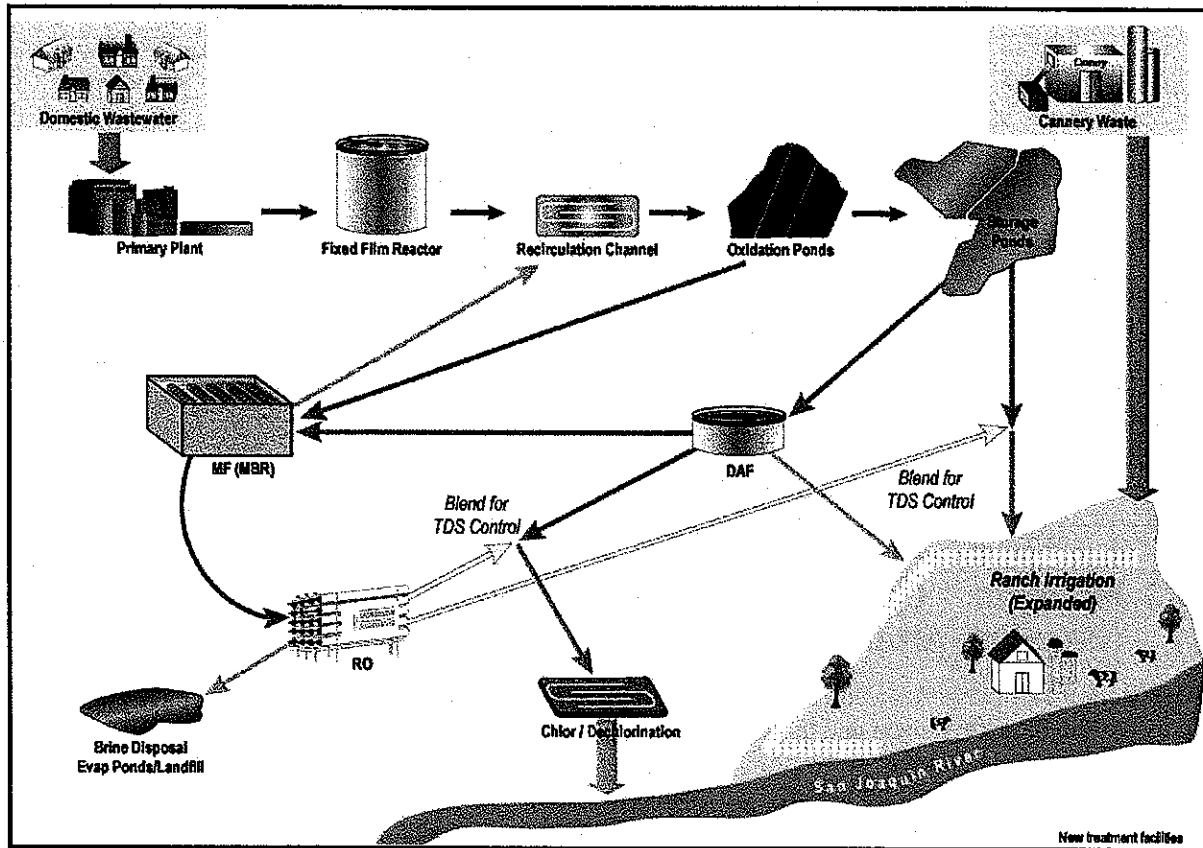


Table 5-9 presents the estimated costs of the Baseline Alternative. For comparison purposes, a cost estimate was prepared for the future flow scenario (2025 flow) assuming RO is not required. This significantly reduces the cost of future wastewater treatment and disposal. The estimated unit costs shown were used to evaluate the range of benefits associated with a recycled water project. These estimated unit costs should not be directly compared to the estimated unit costs of the recycled water alternatives as other benefits of recycled water need to be considered.

**Table 5-9: Estimated Cost Impacts for the Baseline Alternative**

Project Element	Estimated Cost		
	Existing Flow	2025 Flow w/o RO	2025 Flow w/ RO
DAF (10 mgd only) (Operating October and November)	\$3,000,000	\$3,000,000	\$3,000,000
Chlorination (Existing Facility has Capacity to 2025)	\$0	\$0	\$0
Residuals Management Pump Solids to Ranch (Existing Facility Has Capacity to 2025)	\$0	\$0	\$0
Land Purchase/Development (Incr. Disposal Capacity for 25 mgd)	\$0	\$47,600,000	\$47,600,000
<b>Potential Future Cost Risk</b>			
MF Treatment – Submerged (MBR), (25 mgd @ \$3/gal)	\$0	\$0	\$54,825,000
Reverse Osmosis (25 mgd @ \$3/gal)	\$0	\$0	\$75,000,000
Brine Disposal	\$0	\$0	\$10,350,000
<b>Raw Construction Costs</b>	<b>\$3,000,000</b>	<b>\$50,600,000</b>	<b>\$190,775,000</b>
Construction Contingency (50%)	\$1,500,000	\$25,300,000	\$95,388,000
<b>Total Construction Cost</b>	<b>\$4,500,000</b>	<b>\$75,900,000</b>	<b>\$286,163,000</b>
Engr, Legal, Admin, and Environmental (30%)	\$1,350,000	\$22,770,000	\$85,849,000
<b>Total Capital Cost</b>	<b>\$5,850,000</b>	<b>\$98,670,000</b>	<b>\$372,012,000</b>
Annualized Capital	\$425,000	\$7,200,000	\$27,027,000
Annual O&M	\$500,000	\$1,400,000	\$12,375,000
<b>Total Annualized Cost</b>	<b>\$925,000</b>	<b>\$8,600,000</b>	<b>\$39,402,000</b>
<b>Unit Disposal Capacity Cost (per Acre-Ft/Yr)</b>	<b>\$500</b>	<b>\$240</b>	<b>\$1,090</b>

Notes:

1. Annualized costs are based on a 30-year recovery period at 6% interest.
2. Existing flow unit disposal capacity cost was calculated assuming an increase capacity of 1,800 AFY. The 2025 unit disposal capacity cost was calculated assuming an increase of 30.5 mgd (34,200 afy) plus the 1,800 AFY associated with the DAF facilities.

## 5.4 Recycled Water at the Primary Treatment Plant Alternative

The original concept for this alternative is found in the 1995 Wastewater Master Plan. It involves constructing a water recycling facility at the City of Modesto's Primary Plant for distribution within the urban area. Conveyance of wastewater is not required because an adequate supply is available at the Primary Plant. This alternative presents five separate distribution options, depending upon recycled water production (2, 4, 6, 8, and 10 mgd). In general, the proposed distribution piping serves schools, parks, golf courses, and Comprehensive Planning Districts (CPDs), and radiates further out from the Primary Plant with larger diameter piping as flow rates increase. At flow rates of 8 and 10 mgd, industrial customers in the vicinity of Beard Brook Park are added to the distribution. Alternative distribution options and environmental constraints have not been investigated to date. Specific assumptions for this alternative are as follows:

- Disinfected tertiary recycled water (Title 22, 2.2 MPN) is required.
- The Primary Plant requires secondary and tertiary treatment upgrades. Membrane Bio-Reactors (MBR) were selected as a conservative basis to meet filtration requirements.
- Chlorination with Sodium Hypochlorite is the disinfection process assumed for the cost estimate.
- At the Primary plant, existing thickeners and digesters can handle 56 mgd. This is enough to meet future (Year 2025) City of Modesto needs.
- Distribution Options will include schools, parks, golf courses, CPDs, Beard Industrial Area (Ranges: 2, 4, 6, 8, 10 MGD).
- The salinity of the recycled water is expected to range from 500 to 750 mg/l TDS.

- It is assumed that additional distribution infrastructure in the CPD areas would be constructed by the developers.

Figure 5-3 depicts the potential recycled water process train at the Primary Plant for this alternative. Figure 5-4 through 5-8 show the proposed distribution pipelines from the Primary Plant at the various recycled water production rates.

**Figure 5-3: Recycled Water Program at the Primary Plant Schematic**

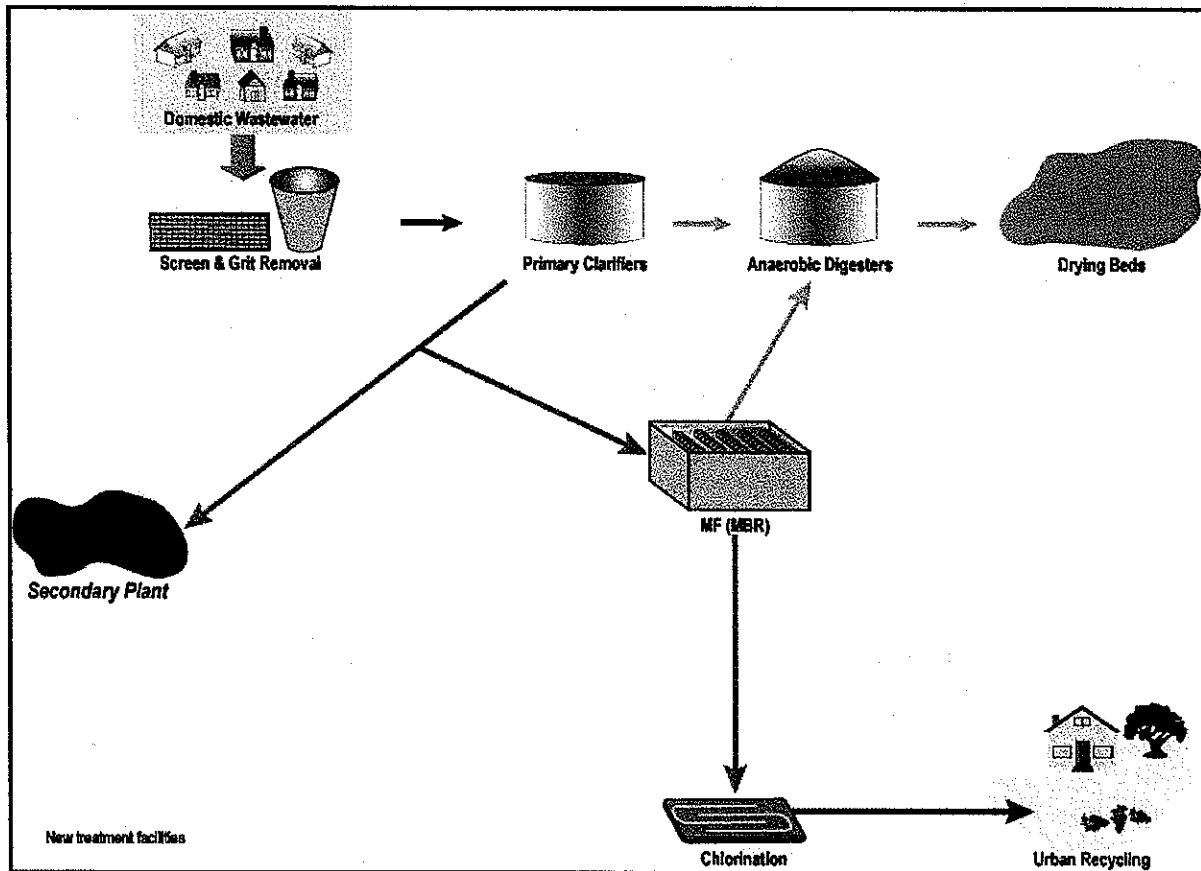


Figure 5-4: Distribution System for 2 MGD of Urban Use

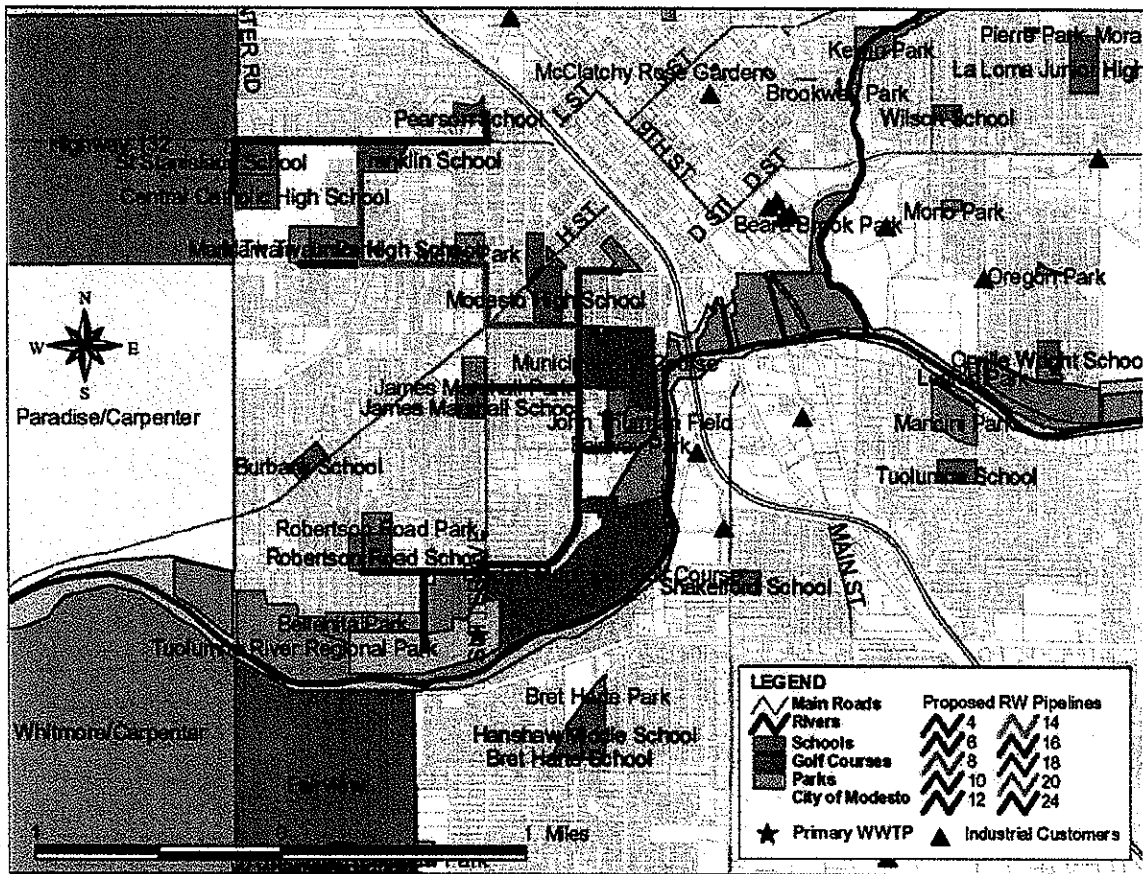


Figure 5-5: Distribution System for 4 MGD of Urban Use

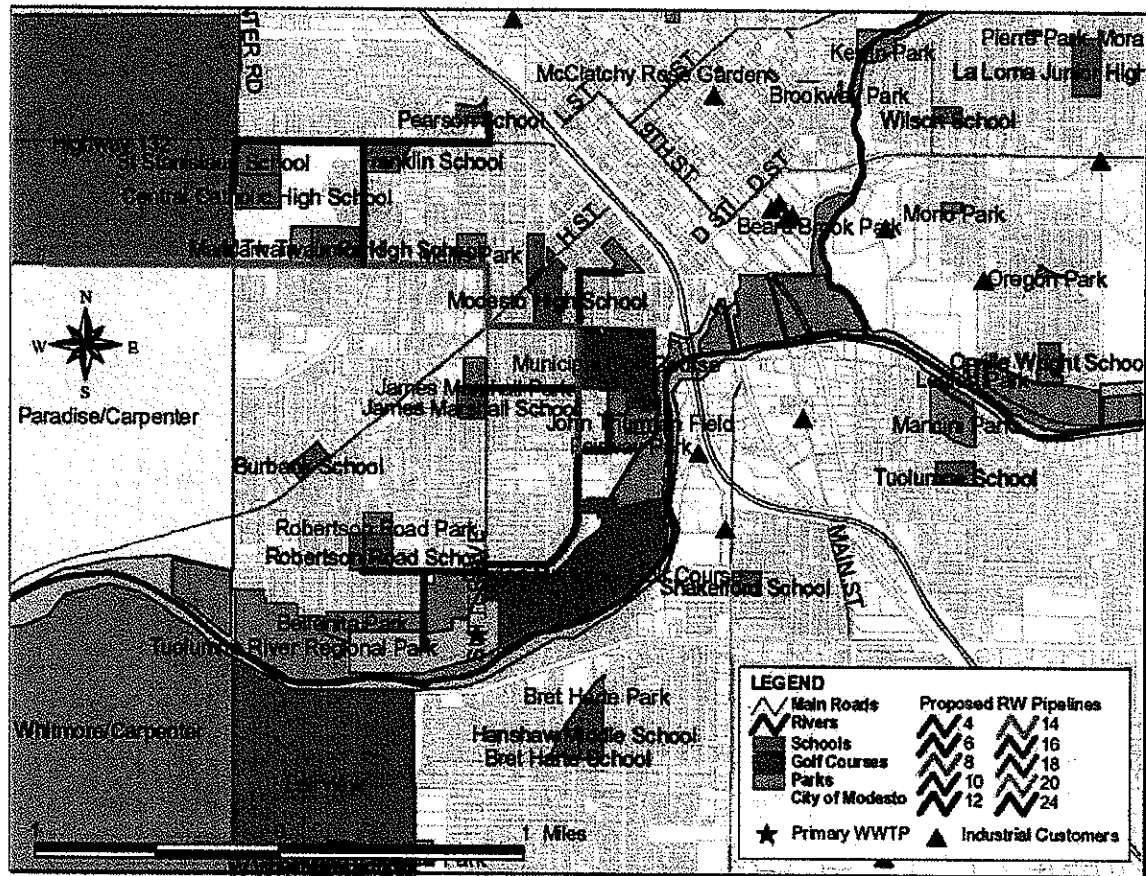
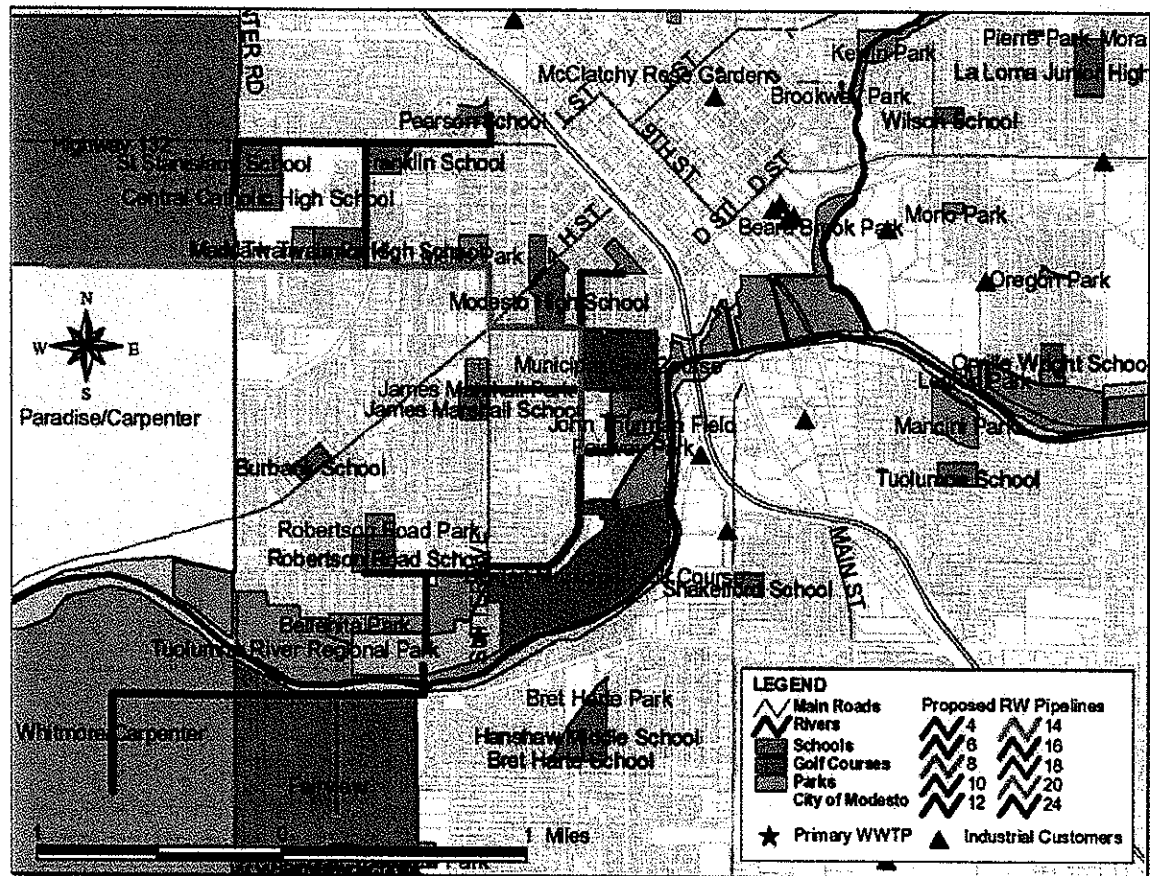
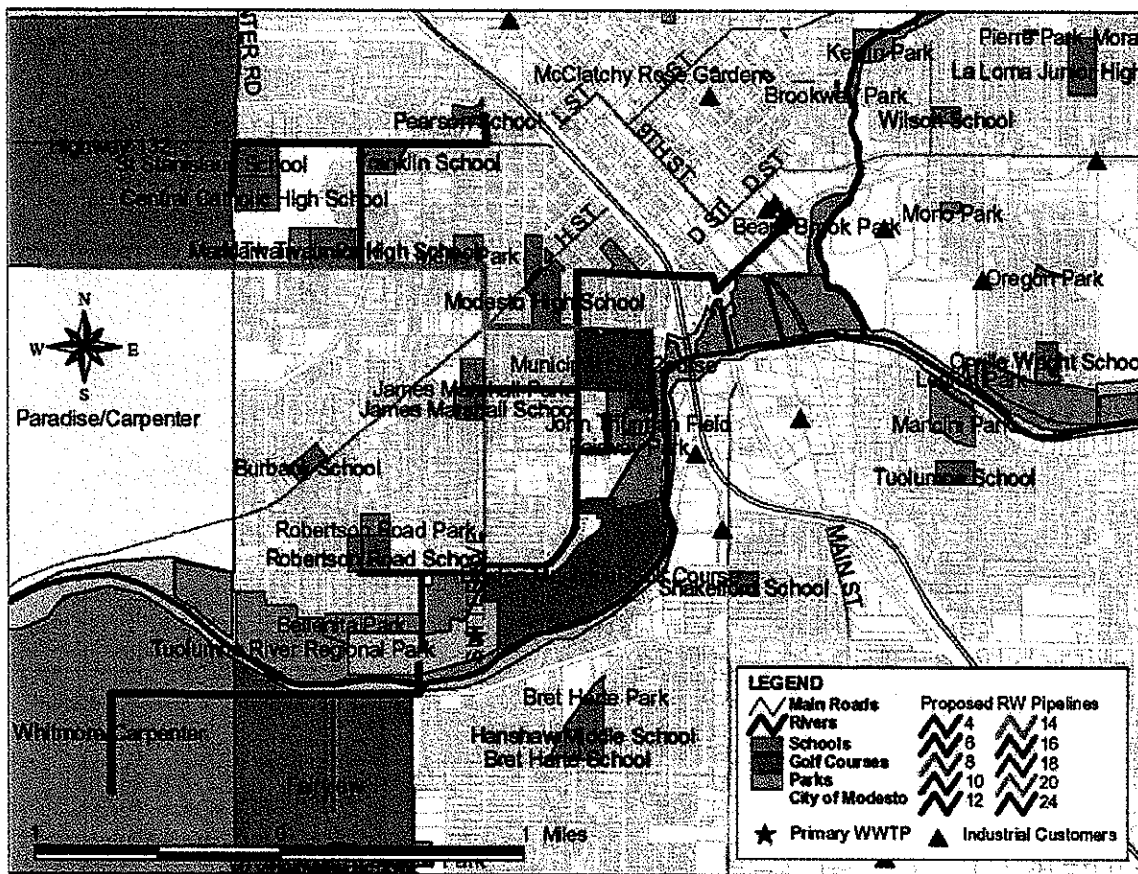


Figure 5-6: Distribution System for 6 MGD of Urban Use



**Figure 5-7: Distribution System for 8 MGD of Urban Use**



**Figure 5-8: Distribution System for 10 MGD of Urban Use**

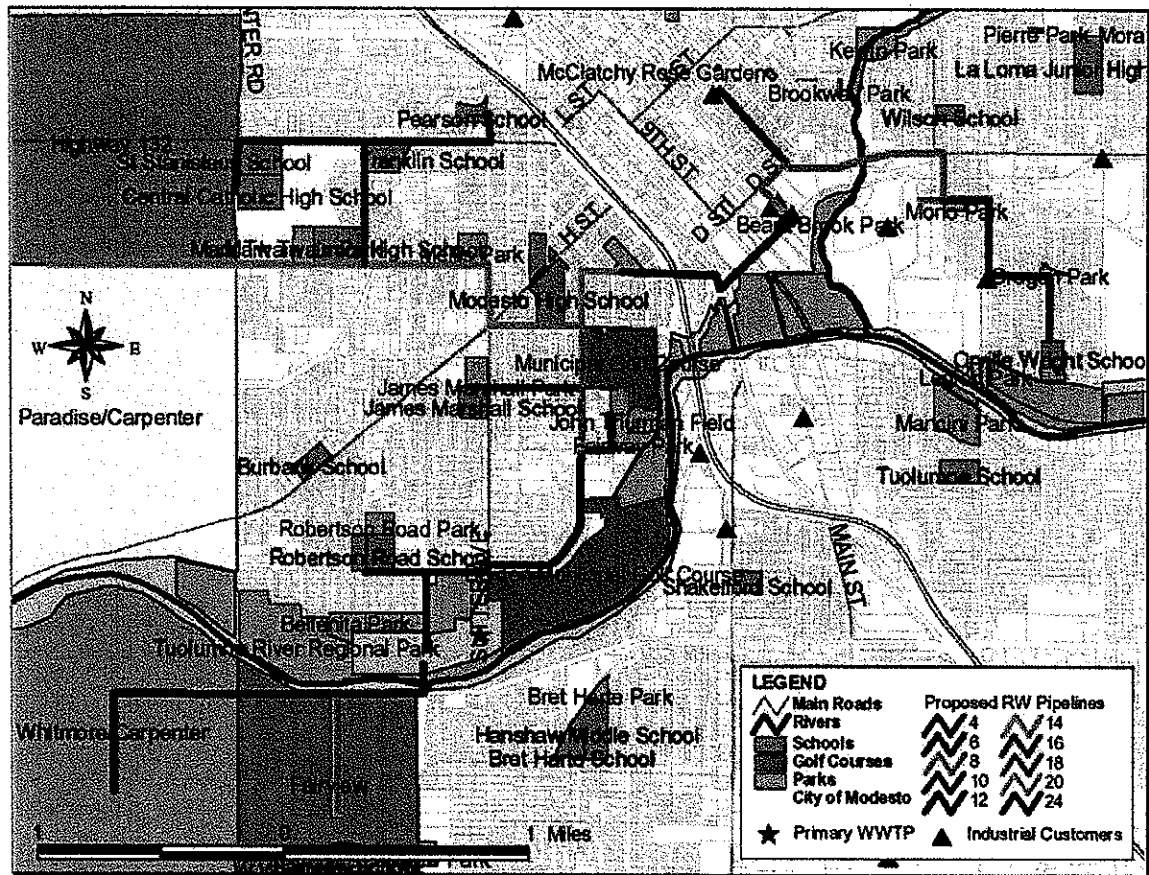


Table 5-10 presents estimated overall costs of a recycled water program at the Primary Treatment Plant. The 10 mgd project has the lowest unit costs at \$1,440 per AF. The 4 mgd project has the highest unit cost at \$1,580 per AF.

**Table 5-10: Estimated Cost of Recycled Water Program at Primary Treatment Plant**

Project Element	Estimated Cost				
	(2 mgd)	(4 mgd)	(6 mgd)	(8 mgd)	(10 mgd)
<b>Recycled Water Treatment</b>					
MF Treatment-Submerged (MBR)	\$4,386,000	\$8,772,000	\$13,158,000	\$17,544,000	\$21,930,000
Chlorination (sodium hypochlorite)	\$540,000	\$1,080,000	\$1,620,000	\$2,160,000	\$2,700,000
Thickeners/Digesters (Existing Facilities Have Adequate Capacity)	\$0	\$0	\$0	\$0	\$0
<b>Recycled Water Distribution</b>					
Pipelines	\$2,530,000	\$3,924,000	\$5,116,000	\$6,172,000	\$7,158,000
Crossings	\$24,000	\$28,000	\$174,000	\$376,000	\$520,000
Pump Station	\$356,000	\$834,000	\$834,000	\$1,182,000	\$1,480,000
Appurtenances	\$255,000	\$395,000	\$529,000	\$655,000	\$768,000
<b>Raw Construction Costs</b>	<b>\$8,091,000</b>	<b>\$15,033,000</b>	<b>\$21,431,000</b>	<b>\$28,089,000</b>	<b>\$34,556,000</b>
Construction Contingency (50%)	\$4,046,000	\$7,517,000	\$10,716,000	\$14,045,000	\$17,278,000
<b>Total Construction Cost</b>	<b>\$12,137,000</b>	<b>\$22,550,000</b>	<b>\$32,147,000</b>	<b>\$42,134,000</b>	<b>\$51,834,000</b>
Right of Way	\$23,000	\$28,000	\$36,000	\$40,000	\$49,000
Engr, Legal, Admin, and Environmental (30%)	\$3,641,000	\$6,765,000	\$9,644,000	\$12,640,000	\$15,550,000
<b>Total Capital Cost</b>	<b>\$15,801,000</b>	<b>\$29,343,000</b>	<b>\$41,827,000</b>	<b>\$54,814,000</b>	<b>\$67,433,000</b>
Annualized Capital	\$1,148,000	\$2,132,000	\$3,039,000	\$3,982,000	\$4,899,000
Recycled Water Treatment O&M	\$514,000	\$1,028,000	\$1,542,000	\$2,056,000	\$2,570,000
Recycled Water Distribution O&M	\$107,000	\$150,000	\$183,000	\$218,000	\$253,000
<b>Combined Annual O&amp;M</b>	<b>\$621,000</b>	<b>\$1,178,000</b>	<b>\$1,725,000</b>	<b>\$2,274,000</b>	<b>\$2,823,000</b>
<b>Total Annualized Cost</b>	<b>\$1,769,000</b>	<b>\$3,310,000</b>	<b>\$4,764,000</b>	<b>\$6,256,000</b>	<b>\$7,722,000</b>
Annual Yield (AFY)	1,140	2,100	3,180	4,250	5,360
<b>Unit Cost (per Acre-Ft/Yr)</b>	<b>\$1,550</b>	<b>\$1,580</b>	<b>\$1,500</b>	<b>\$1,470</b>	<b>\$1,440</b>

Notes:

1. Annualized costs are based on a 30-year recovery period at 6% interest.
2. Annual yield was based on the estimated demand of the potential customers. The customers identified have a maximum month daily demand of 2, 4, 6, 8, and 10 mgd.

## 5.5 Satellite Treatment Facilities Alternatives

This alternative incorporates recycled water production from combined Ripon/Salida flows at the Salida Plant location, with delivery to the Salida, Stoddard, and Highway 99 CPDs. The alternative is representative of similar facilities that may be constructed at Oakdale, Patterson, or Hughson, for example, to treat neighboring communities' flows to Title 22 disinfected tertiary recycled water standards for local distribution. Specific assumptions for this alternative are as follows:

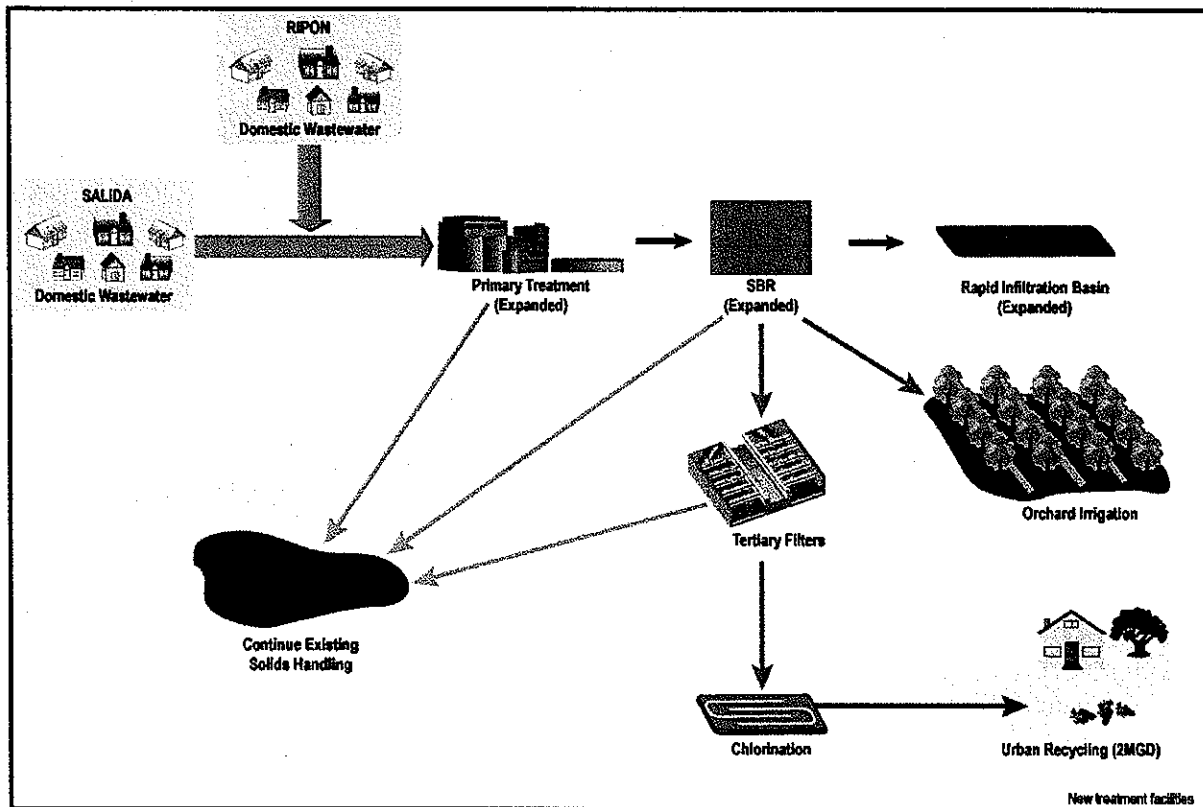
- Disinfected tertiary recycled water is required to serve to the CPDs (Highway 99, Salida, and portion of Stoddard).
- Title 22 tertiary treatment facilities are assumed to be located at the Salida Wastewater Treatment Plant (WWTP).
- Existing flow of Ripon and Salida is approximately 2.3 mgd.
- Recycled water production is assumed to be 2 mgd.
- It is assumed that improvements to the existing treatment facilities are required at the Salida WWTP location to serve the combined flow. Effluent disposal upgrades are necessary to accommodate flow during the winter months. Specifically, expansion of influent pumping and screening, primary clarifiers and sludge handling, existing sequencing batch reactors, and

infiltration basins is assumed. Conventional filtration and disinfection with sodium hypochlorite is assumed for tertiary treatment.

- It is assumed that the existing sludge handling process is sufficient to meet the needs of Ripon and Salida.
- The estimated cost includes major transmission pipelines to the CPDs. However, it is assumed developers of the CPD would construct the distribution infrastructure that connects to the transmission pipeline.

Figure 5-9 depicts the potential recycled water process train at the combined Ripon/Salida WWTP for this alternative. Figure 5-10 shows major transmission pipelines from the Ripon/Salida WWTP to the CPDs.

**Figure 5-9: Ripon/Salida Satellite Schematic**



Satellite treatment facilities could also be implemented in the City's sewer service area. Conceptually, treatment facilities could be implemented with development of the CPDs. Recycled water would be used for landscape irrigation at golf courses, parks, school yards, and road medians. Satellite facilities could also be implemented in the existing service area near potential customers.

Figure 5-10: Major Transmission Pipelines to CPD

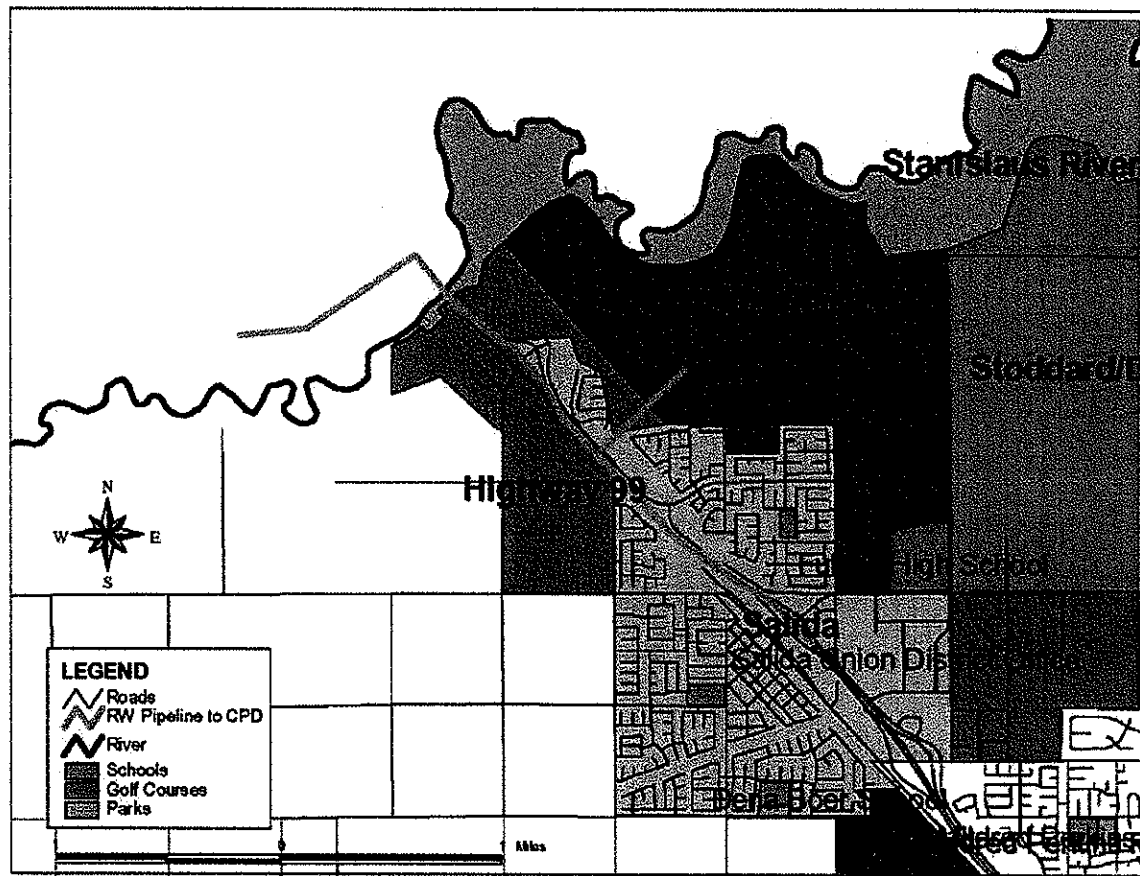


Table 5-11 presents estimated overall costs of a recycled water program utilizing a satellite treatment facility at a joint Ripon/Salida WWTP. This alternative was developed as an example concept that could be developed with other groups of stakeholders. Treatment upgrades and requirements will vary with each group of stakeholders and depending on the existing wastewater treatment facilities. Distribution infrastructure will also vary depending on the location of recycled water market areas.

**Table 5-11: Estimated Cost of RW at Satellite Treatment Facility (Ripon and Salida)**

<b>Project Element</b>	<b>Estimated Cost</b>
<b>Recycled Water Treatment (2 MGD)</b>	
Primary Treatment Upgrade	\$3,000,000
Expand Existing SBR	\$3,000,000
Conventional Filters	\$528,000
Chlorination (sodium hypochlorite)	\$540,000
Residuals Management (Assume continued solids handling practices/capacity adequate)	\$0
Expand Existing Infiltration Basins	\$704,000
<b>Conveyance System</b>	
Pipelines	\$1,331,000
Crossings	\$64,000
Pump Station	\$40,000
Appurtenances	\$140,000
<b>Recycled Water Distribution</b>	
Pipelines	\$2,116,000
Crossings	\$240,000
Recycled Water Pump Station	\$370,000
Appurtenances	\$236,000
<b>Raw Construction Costs</b>	<b>\$12,309,000</b>
Construction Contingency (50%)	\$6,155,000
<b>Total Construction Cost</b>	<b>\$18,464,000</b>
Right of Way	\$23,000
Engr, Legal, Admin, and Environmental (30%)	\$5,539,000
<b>Total Capital Cost</b>	<b>\$24,018,000</b>
Annualized Capital	\$1,745,000
Conveyance System O&M	\$83,000
Recycled Water Treatment O&M	\$422,000
Recycled Water Distribution O&M	\$104,000
Combined Annual O&M	\$609,000
<b>Total Annualized Cost</b>	<b>\$2,354,000</b>
Annual Yield (AFY)	1,060
<b>Annualized Cost/(Acre-Ft/Yr)</b>	<b>\$2,220</b>

**Notes:**

1. Annualized costs are based on a 30-year recovery period at 6% interest.
2. Annual yield was based on the estimated demand. The customers identified have a maximum month demand of 2 mgd.

## 5.6 Water Sale Alternative

Several Irrigation District (ID) expressed potential interest in recycled water as a source of supplementary irrigation supply. The ID would utilize recycled water to supplement its existing CVP contract supply from the Delta Mendota Canal and its San Joaquin River diversion right. Water quality in the San Joaquin River is often less than desirable for irrigation water use, particularly as related to TDS. Under this alternative, the City of Modesto would produce recycled water at the Secondary Plant and pump the water through a new distribution pipeline to an ID. The concept of the City of Modesto or other satellite plants delivering recycled water to agricultural interests underlying this alternative may be employed in other locations. Specific assumptions for this alternative are as follows:

- Assume a filtered, disinfected tertiary recycled water supply that meets unrestricted irrigation use is needed for the water sale.

- The 37 mgd Title 22 Facility would be sited at the Secondary Plant. This assumes an annual demand of 20,000 AFY is served over a 6 month period. The 37 mgd flow rate is greater than the existing average municipal flow rate to the Jennings WWTP. However, it is assumed that flow from the storage ponds could be used to meet the 37 mgd demand. Future development is expect to increase the municipal flow available.
- Assumes DAF is required to address algae from the ponds.
- Treatment facilities are assumed to include tertiary filters and sodium hypochlorite disinfection. Solids generated would be returned back to the pond system or ranch.
- The cost estimate includes a 13.4 mile transmission pipeline (36 inch) to an ID (at upper end of system for blending with CVP and/or river water.) It is assumed that the existing ID distribution system could be used to deliver water to growers.
- It is assumed that the ID would blend recycled water with CVP water to meet grower water quality (TDS) goals. The salinity of the recycled water is expected to range from 500 to 750 mg/l TDS, with a blended water quality range from 400 to 525 mg/l TDS (assumes a one to one blend of recycled water to CVP water with a TDS of 300 mg/l).

Figure 5-11 depicts the potential recycled water process train at the Secondary Plant for this alternative.

**Figure 5-11: Water Sale Alternative Schematic**

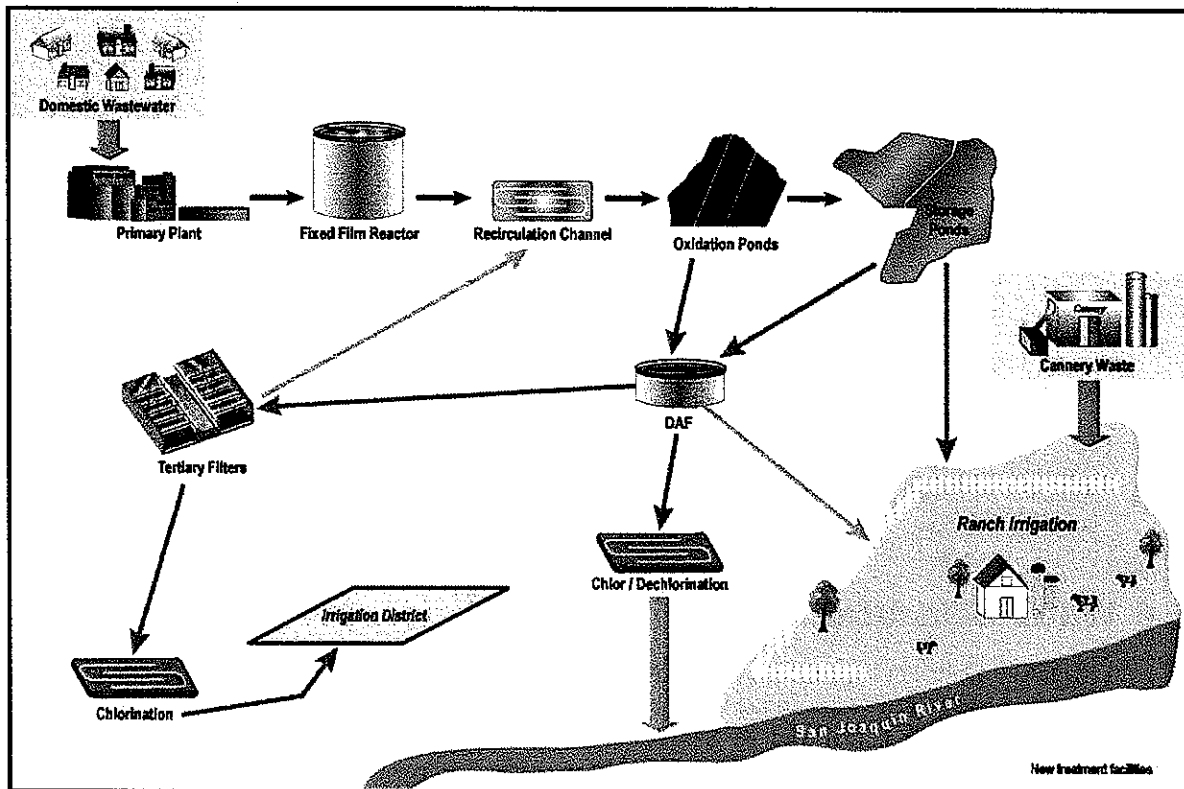


Table 5-12 presents estimated overall costs of a 37 mgd alternative including the facility and transmission pipeline to an ID.

**Table 5-12: Estimated Cost of RW at Secondary Treatment Facility (Sale to an ID)**

<b>Project Element</b>	<b>Estimated Cost</b>
<b>Recycled Water Treatment (37 mgd)</b>	
DAF	\$11,100,000
Conventional Filters	\$9,768,000
Chlorination (sodium hypochlorite)	\$9,990,000
Residuals Management (Assume filter solids pumped to Recirculation Channel [cost] and DAF solids applied to Ranchlands as currently done [no capital cost])	\$925,000
<b>Recycled Water Distribution to an ID (37 mgd)</b>	
Pipelines (13.4 miles of 36 inch)	\$25,380,000
Crossings	\$1,098,000
Pump Station	\$8,723,000
Appurtenances	\$2,011,000
<b>Raw Construction Costs</b>	<b>\$68,995,000</b>
Construction Contingency (50%)	\$34,497,500
<b>Total Construction Cost</b>	<b>\$103,493,000</b>
Right of Way	\$48,000
Engr, Legal, Admin, and Environmental (30%)	\$31,047,900
<b>Total Capital Cost</b>	<b>\$134,589,000</b>
Annualized Capital	\$9,778,000
Recycled Water Treatment O&M	\$3,996,000
Recycled Water Distribution O&M	\$695,000
Combined Annual O&M	\$4,691,000
<b>Total Annualized Cost</b>	<b>\$14,469,000</b>
Annual Yield (AFY)	20,000
<b>Annualized Cost/(Acre-Ft/Yr)</b>	<b>\$720</b>

Notes:

1. Annualized costs are based on a 30-year recovery period at 6% interest.

This alternative could be expanded to include delivery of recycled water to the San Joaquin River National Wildlife Refuge (SJRNWR), which is owned and operated by the US Fish & Wildlife Service. The SJRNWR receives its water supply through a diversion from the San Joaquin River. Further refinement of the recycled water delivery alternative should include the option to deliver water to the Wildlife Refuge, particularly since the refuge water supply would likely be required during the winter to spring months, compared to the supply of recycled water for irrigation purposes during the summer and fall months.

## **5.7 Satellite Recycled Water (Beard Industrial Area) and Joint Cogeneration Project**

This final alternative considers siting a new satellite or scalping plant along the existing Cannery Segregation pipeline upstream from the City of Modesto Primary Plant. The Cannery Segregation pipeline is normally in service from July to September and collects flows from the food (canning) industry. Recycled water production from the new satellite plant would (1) serve a cogeneration facility located at the same site and/or (2) be distributed to industrial users within the Beard Industrial Area. Significant recycled water demands within the Beard Industrial Area include food and fruit companies, newspaper publishing, paper production, and wineries. Specific details and assumptions for this alternative are as follows:

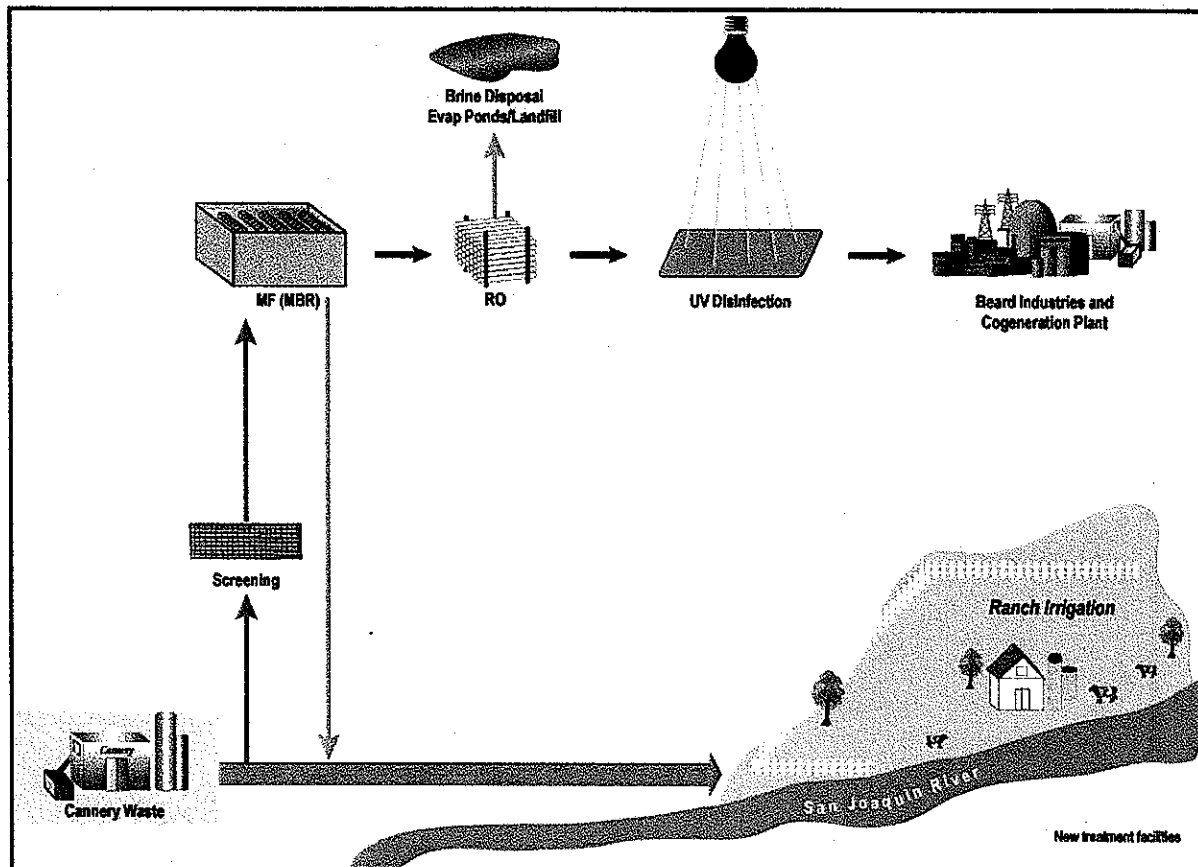
- The cogeneration project has yet to be defined pending the results of a proposed feasibility study of cogeneration potential for the Beard Industrial Park. Recycled water demand for the

Cogeneration Facility is assumed to be 5 mgd. The 5 mgd project includes a transmission pipeline to the Cogeneration Facility.

- Industrial use may increase demand by another 5 mgd for a 10 mgd project in total.
- This alternative is envisioned to only operate during the canning season.
- The satellite and cogeneration facility are assumed to be constructed together along the Cannery Segregation pipeline alignment. Therefore, there is no need for additional wastewater conveyance.
- It is assumed that a portion of the cannery flow would be treated and the remaining flow would be left in the cannery segregation pipeline. Cannery Segregation flows averaged between 13 and 21 mgd from 2000 to 2002.
- It is assumed that advanced treatment is required to meet water quality objectives of the customer as the TDS of the segregated cannery flow ranges from 1,000 to 1,700 mg/l with an average of approximately 1,400 mg/l. Screens, MBR, and RO treatment are assumed. UV disinfection is the assumed disinfection process.
- Solids from MBR would go back to the Cannery Segregation Pipeline.
- Brine disposal through evaporation ponds and landfill would need to be implemented in conjunction with the RO facility.
- Under this alternative, there would be a potential avoidance of ranch land expansion at the Secondary Site, since approximately 224 acres are required per mgd for disposal of cannery waste. At \$8,500 per acre for purchase and development of land, this savings could approach \$19,040,000 (for a 10 mgd project), without contingencies.

Figure 5-12 depicts the potential recycled water process train at the Beard Satellite facility for this alternative. Figure 5-13 shows distribution pipelines from the facility to surrounding industrial clients.

Figure 5-12: Beard Satellite Schematic



**Figure 5-13: Distribution System for 10 mgd Satellite Project**

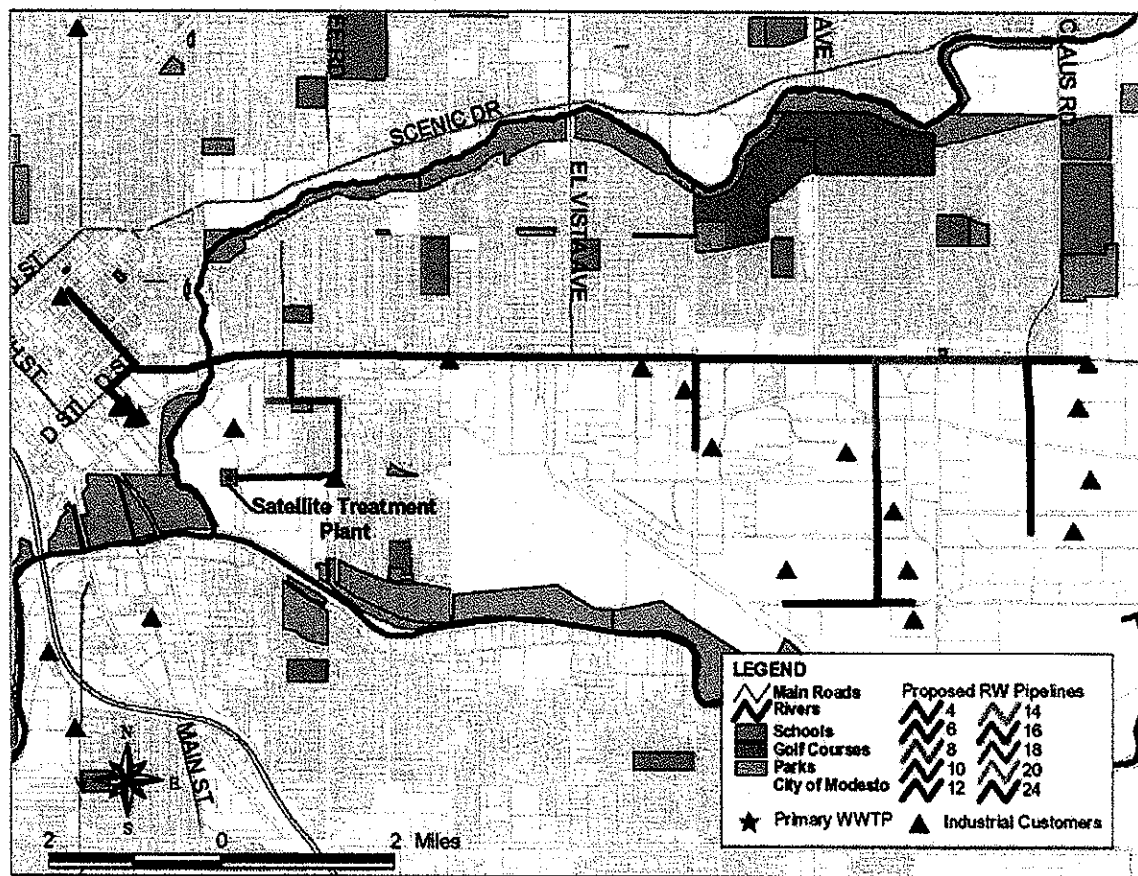


Table 5-13 presents estimated overall costs of a Beard Satellite Alternative including the treatment facilities and distribution pipelines. Currently, the City of Modesto is pursuing funding for a planning level study on a cogeneration project. If the City elects to move forward with the cogeneration project, additional investigations on this satellite reclamation options are recommended.

**Table 5-13: Estimated Cost of RW at Satellite Treatment Facility (Beard Treatment Facility)**

Project Element	Estimated Cost		
	5 MGD	10 MGD w/o RO	10 MGD
<b>Recycled Water Treatment</b>			
MF Treatment - Submerged (MBR)	\$10,965,000	\$21,930,000	\$21,930,000
Reverse Osmosis	\$16,760,000	\$0	\$33,520,000
Brine Disposal	\$2,070,000	\$0	\$4,140,000
UV Disinfection	\$1,700,000	\$3,400,000	\$3,400,000
Residuals Management (Solids drained into Cannery Segregation line (to Primary Plant))	\$50,000	\$100,000	\$100,000
<b>Recycled Water Distribution (to an Irrigation District)</b>			
Pipelines	\$90,000	\$4,266,000	\$4,266,000
Crossings	\$0	\$222,000	\$222,000
Recycled Water Pump Station	\$422,000	\$1,453,000	\$1,453,000
Appurtenances	\$9,000	\$449,000	\$449,000
<b>Raw Construction Costs</b>	<b>\$32,066,000</b>	<b>\$31,820,000</b>	<b>\$69,480,000</b>
Construction Contingency (50%)	\$16,033,000	\$15,910,000	\$34,740,000
<b>Total Construction Cost</b>	<b>\$48,099,000</b>	<b>\$47,730,000</b>	<b>\$104,220,000</b>
Right of Way	\$0	\$31,000	\$31,000
Engr, Legal, Admin, and Environmental (30%)	\$14,430,000	\$14,319,000	\$31,266,000
<b>Total Capital Cost</b>	<b>\$62,529,000</b>	<b>\$62,080,000</b>	<b>\$135,517,000</b>
Annualized Capital	\$4,543,000	\$4,510,112	\$9,845,000
Recycled Water Treatment O&M	\$1,975,000	\$1,340,000	\$3,950,000
Recycled Water Distribution O&M	\$86,000	\$199,000	\$199,000
Combined Annual O&M	\$2,061,000	\$1,539,000	\$4,149,000
<b>Total Annualized Cost</b>	<b>\$6,604,000</b>	<b>\$6,049,112</b>	<b>\$13,994,000</b>
Annual Yield	1,380	2,760	2,760
<b>Annualized Cost/(Acre-Ft/Yr)</b>	<b>\$4,790</b>	<b>\$2,190</b>	<b>\$5,070</b>

**Notes:**

1. Annualized costs are based on a 30-year recovery period at 6% interest.
2. Annual yield is calculated based on 3 months of operation (90 days) at 5 and 10 mgd.

## 5.8 Potential Alternative Benefits

Besides project costs, there are a number of potential financial and non-financial benefits that must be considered when selecting a project. These benefits include sale of recycled water, potable water supply benefit, avoided cost of disposal capacity upgrades, avoided cost of water supply facility upgrades, and supply reliability. It should be noted that some of the potential benefits for the project are dependent on the market being serviced and the undertaking of additional action for the benefit to be realized. The potential project benefits are discussed below.

### 5.8.1 Recycled Water Cost Recovery Benefit

Recycled water is a valuable commodity that could be sold to recover costs of the project. Like any commodity, market conditions will govern the sale of recycled water. For existing customers, rates for recycled water would need to be similar to existing water rates. The City of Modesto water rate for non-potable uses such as school irrigation is approximately \$120 per AF. It is assumed that a similar water rate would apply for park irrigation, CPD's, and industrial use. This benefit is realized by serving new

customers (CPD's). For service to existing customers, the potable water supply benefit (describe below) would apply.

For the water sale alternative, the rate that recycled water could be sold is dependent on a number of economic factors. Additional discussion with potential customers and economic evaluations are needed to identify feasible rates. For this benefit assessment it was assumed that recycled water has a value of \$50 per AF.

### **5.8.2 Potable Water Supply Benefit**

Water use in the City of Modesto service area is expected to increase by approximately 40,100 AFY under the currently defined general plan build-out scenario (West Yost & Associates, March 2003). Serving recycled water within the City of Modesto service area would reduce the use of higher quality water supplies. These higher quality supplies could then be used for other beneficial uses that required potable water supplies. Both economic and non-economic benefits could be realized by conserving these higher quality water supplies. The City of Modesto rate schedule for water service incorporates the meter charge and water rate into one monthly charge. Included in the monthly charge is a water allotment of 1,680 cf. The exact breakdown of the meter charge and water rate is unknown, therefore, the water rate is assumed to be approximately \$350 per AF for this benefit assessment. This water rate is expected to increase in the future.

In order to realize the financial benefit associated with the conservation of potable water, the water would need to be served to another customer. New residential or business development could be supported by the freed up potable water supply. The City of Modesto would realize this benefit only if recycled water were served within the City's service area. For the Water Sale Alternative and Ripon/Salida Satellite Alternative, this benefit would not be realized for the City.

The Water Sale Alternative could lead to conservation of CVP water or San Joaquin River Water. These supplies have the potential to be used for potable uses by other agencies and could result in some financial benefits for the City of Modesto.

### **5.8.3 Avoided Cost of Wastewater Disposal Capacity Upgrades**

Implementation of a recycled water project may reduce the need for future disposal capacity upgrades at the wastewater treatment plants. Recycled water use is a disposal option that would reduce the need to construct alternative disposal measures. Under the Baseline Alternative, disposal capacity upgrades would include construction of DAF facilities and purchase of additional land to facilitate land disposal. The avoided cost of these facilities would be a significant financial benefit. The unit cost estimate of \$250 per AF for the Baseline Alternative (2025 estimated unit cost without RO treatment) can be used as an estimate of the avoided cost of disposal capacity upgrades.

Potential future surface water and land disposal treatment requirements may also be avoided if a recycled water project is implemented. For example, if RO treatment is required in the future for percolation or surface water discharge then recycled water requiring tertiary treatment and disinfection may be more practical. Several stakeholders in the region are now being required by the RWQCB to meet drinking water standards prior to discharge to the percolation ponds. If RO is required in the future, the estimated unit cost for disposal may be \$1,090 per AF.

It should be realized that this avoided cost of disposal does not have the same beneficiary for all of the alternatives. For the Ripon/Salida Satellite Treatment Alternative, the Cities of Ripon and Salida are the beneficiaries of the alternative. The other recycled water alternatives (water sale, primary treatment/urban

use, and Beard satellite) would benefit the City of Modesto as tributary flows to the City WWTP's are used.

The seasonal nature of recycled water demand needs to be considered when evaluating this benefit. The City of Modesto is expected to have a significant benefit because of the availability of storage ponds that can store winter flows that would then be used during the irrigation season. Without the storage ponds, low winter recycled water demands may necessitate disposal upgrades be implemented regardless of recycled water use.

#### **5.8.4 Avoided Cost of Water Supply Capacity Upgrades**

As discussed above, recycled water use would reduce the use of existing potable water supplies. Conservation of potable water supply also results in an avoided cost associated with increased water supply capacity. Future capacity upgrades are expected in the future as development and population increase in the City service area. This avoided cost should be considered when assessing the value of a recycled water project. This benefit is realized if recycled water is used to offset potable water use in the City service area.

This benefit value was estimated based on the estimated cost of water treatment plant upgrades to provide water to meet future demand increases. The estimated cost of the treatment plant upgrades (36 mgd) at the existing MID water treatment plant is \$25 million with an annual O&M of \$1.84 million (based on correspondence with Phil Gittens). Assuming 100% production (36 mgd for 365 days), the estimated cost of this project is approximately \$90 per AF.

The City of Modesto would realize this benefit if recycled water is used within its service area. Under the Water Sale Alternative, the City of Modesto would not realize this benefit as recycled water would not conserve any potable water supply for the City.

#### **5.8.5 Avoided Cost of Future Water Supply**

Fresh water is a valuable resource in limit quantities. Currently, the City (through agreements with MID) appears to have near-term water supply available to meet demand. However, as development continues and surface water and groundwater supplies are completely allocated, the cost for the next increment of supply is expected to be higher than the \$90 per AF (Avoided Cost of Water Supply Capacity Upgrades). The Avoided Cost of Future Water Supply is the added benefit associated with eliminating or further delaying the need to develop more costly water supply options (i.e. new dam and reservoir, brackish water desalination, etc). This benefit can be quantified by evaluating the future water supply projects that may be needed to meet demand. An estimated value of this benefit has not been quantified to date.

#### **5.8.6 Water Supply Reliability**

Water supply reliability is a significant issue for the region as surface water supplies that are hydrologically dependent make up a significant portion of the water supply. To some extent groundwater supply is also hydrologically dependent as groundwater recharge is reduced during drought years. Recycled water is a reliable supply that is considered to be hydrologically independent. Increased recycled water use would enhance the overall reliability of water supply and would provide a valuable resource during drought conditions. Although the value of reliability has been quantified by other water agencies, the benefit of reliability has not been quantified for this project. It should be noted that a major portion of Modesto's water supply is provided by MID which has a relatively reliable surface water supply. For the Water Sale Alternative, water reliability could be a more significant benefit as CVP contractors and other surface water users are subject to annual hydrologic conditions.

### **5.8.7 Environmental Enhancement**

The San Joaquin River is an impacted water body that is listed on the 303(d) list. A sizable recycled water project could have environmental benefits associated with limiting pollutant loads to the San Joaquin River. Significant levels of recycled water use may reduce the need for wastewater disposal to the San Joaquin River.

The Water Sale Alternative may reduce the demand for river water if a water sale alternative is implemented with an ID that currently diverts river water. It is envisioned that a recycled water project would reduce demand for San Joaquin River water allowing the river flow to continue down the Sacramento-San Joaquin Delta. This would likely have both environmental and water supply benefits for the delta and is estimated to have a value of \$150 per AF.

Recycled water could also be used to support or enhance wetlands or other riparian or aquatic habitat. Use of the recycled water in the SJRNWR is one opportunity to enhance wetlands. The USFWS indicated that recycled water may be able to augment flows from the San Joaquin River that are currently used. An estimated value of environmental restoration has not been quantified to date.

### **5.8.8 Regionalization Benefit**

A regional recycled project would allow for cost-sharing opportunities and economy of scale benefits for the participating stakeholders. The raw wastewater conveyance options are an opportunity for various stakeholders to participate in one regional project. By combining treatment and disposal operations only one discharge permit would be required. Operations and maintenance and administrative tasks would be combined allowing for cost share opportunities. The Ripon and Salida Satellite Treatment Alternative is an example of an opportunity for stakeholders to work together to meet future water needs and wastewater treatment and disposal needs. The financial benefit of regionalization is difficult to quantify.

### **5.8.9 Summary of Benefit Values**

Table 5-14 summarizes the benefit values and assumptions for each of the benefits above. The values can be compared to estimated alternative costs to assess the feasibility of the project alternatives and develop conclusions.

**Table 5-14: Assumptions for the Benefit Cost Curve**

Benefit	Benefit Value per AF	Comment
Recycled Water Supply	\$120 City \$50 ID	This benefit value is the assumed estimated rate that could be charged for recycled water. This rate is based on current non-potable water rate for the City of Modesto. For recycled water to an Irrigation District, it is assumed that recycled water would replace river diversions. At this phase in the study it is assumed that recycled water has a \$50 value to an Irrigation District for this benefit analysis.
Potable Water Supply	\$350	Potable water supply would be freed up by serving recycled water to existing customer that use potable supplies for irrigation. The potable water could then be used to meet future demand. The value of potable water supply is expected to increase in the future. This value was estimated based on City of Modesto residential water rate of \$350 for water service and meter (meter charge was assumed to be \$50 per AF).
Avoided Cost of Disposal Capacity Upgrade	\$250 to \$1,090	A benefit value range was estimated based on the Baseline Alternative. The range was developed assuming purchase of additional land for disposal with and without RO treatment.
Avoided Cost of Water Supply Upgrade	\$90	This benefit value was estimated based on the estimated cost of water treatment plant upgrades to provide water to meet future demand increases. The estimated cost of the treatment plant upgrades (36 mgd) at the existing MID water treatment plant is \$25 million with an annual O&M of \$1.84 million (based on email correspondence with Phil Gittens).
Avoided Cost of Future Water Supply	\$0	This benefit is associated with future water supply projects that will be more costly than the MID water treatment plant. This benefit value can be estimated based on the cost of future (more costly) water supply projects that are necessary to meet long-term water use. This benefit value is assumed to be \$0 per AF for this benefit assessment.
Water Supply Reliability	\$0	Reliability benefits are difficult to quantify and can vary depending on the sources of supply that are available. Reliability can be enhanced through implementation of storage projects, purchase of additional supply, and through several other means. Because of the quantity, reliability, and relatively inexpensive surface water supply in the region it is assumed that the value of reliability is negligible.
Environmental Benefits	\$150	Environmental benefits could result in linkages to funding for the project. The benefit value for environmental enhancement or restoration is difficult to ascertain. The environmental benefit associated with the Water Sale Project (reducing San Joaquin River diversions) is assumed to be \$150 per AF.
Regional Benefits	\$0	Regional benefits are difficult to quantify as the benefits vary with each stakeholder. For this benefit assessment it is assumed that the regional benefit is negligible.

It should be noted that these benefit values only represents a cursory evaluation. The estimated benefits represent a conceptual planning level analysis with a number of assumptions. As part of the next steps, the benefit values should be refined.

## 5.9 Alternative Assessment

Table 5-15 presents a summary of costs for the five Northern San Joaquin Valley Recycled Water Alternatives that were evaluated. Estimated costs for the conveyance options are not included in the summary table.

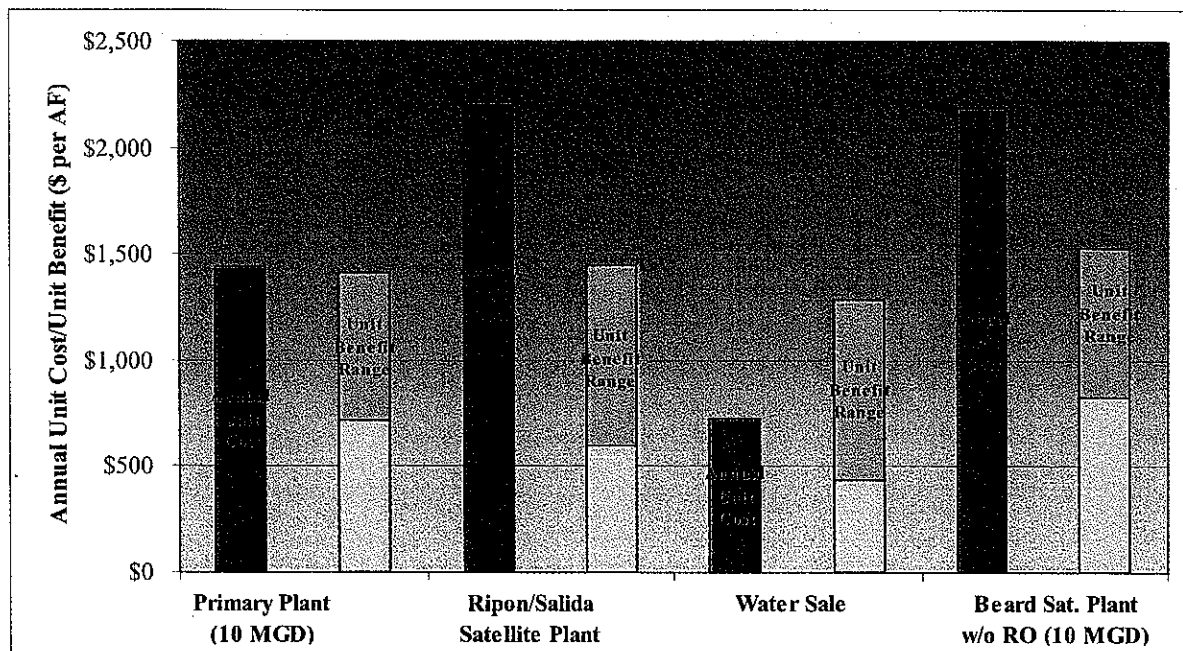
It should be noted that the alternatives above have only been evaluated to a feasibility level. Additional work is necessary to refine project elements and costs. In addition to project costs, the project benefits above should be considered when selecting a recommended alternative. Potential benefits are related to water supply, wastewater disposal, supply reliability, environmental enhancement, and regionalization. Other factors such as ease of implementation, public acceptance, and political feasibility should also be considered. Given the conceptual nature of this evaluation only preliminary conclusions can be drawn regarding a recommended recycled water alternative. The following paragraphs highlight some of the benefits and considerations associated with each alternative.

**Table 5-15: Summary of Estimated Costs**

Project Alternative	Raw Construction Costs	Total Construction Cost	Total Capital Cost	Total Annualized Cost	Unit Cost (per Acre-Ft/Yr)
<b>Modesto Only/No RW Project Alternative</b>					
Existing Flow, 25.5 MGD	\$3,000,000	\$4,500,000	\$5,850,000	\$925,000	\$500
2025 Flow w/o RO	\$50,600,000	\$75,900,000	\$98,670,000	\$8,600,000	\$240
2025 Flow w/ RO	\$190,775,000	\$286,163,000	\$372,012,000	\$39,402,000	\$1,090
<b>Recycled Water Plant at the Primary Treatment Plant Alternative</b>					
2 MGD	\$8,091,000	\$12,137,000	\$15,801,000	\$1,769,000	\$1,550
4 MGD	\$15,033,000	\$22,550,000	\$29,343,000	\$3,310,000	\$1,580
6 MGD	\$21,431,000	\$32,147,000	\$41,827,000	\$4,764,000	\$1,500
8 MGD	\$28,089,000	\$42,134,000	\$54,814,000	\$6,256,000	\$1,470
10 MGD	\$34,556,000	\$51,834,000	\$67,433,000	\$7,722,000	\$1,440
<b>Ripon and Salida Satellite Treatment Plant Alternative, 2 MGD</b>	\$12,309,000	\$18,464,000	\$24,018,000	\$2,354,000	\$2,220
<b>Water Sale Alternative, 37 MGD</b>	\$68,995,000	\$103,493,000	\$134,589,000	\$14,469,000	\$720
<b>Beard Satellite Treatment Plant Alternative</b>					
5 MGD	\$32,066,000	\$48,099,000	\$62,529,000	\$6,604,000	\$4,790
10 MGD w/o RO	\$31,820,000	\$47,730,000	\$62,080,000	\$6,049,000	\$2,190
10 MGD w/ RO	\$69,480,000	\$104,220,000	\$135,517,000	\$13,994,000	\$5,070

The benefits of each alternative were assessed and compared to estimated alternative costs to assess the feasibility of the project alternatives and develop conclusions. Figure 5-14 shows a comparison of the annual unit cost and estimated unit benefit of the alternatives. Benefit value of the urban and water sale alternatives may exceed project costs providing a net benefit. The Ripon/Salida alternative and Beard alternative do not appear to be practical. However, due to the very conceptual nature it is recommended that these alternatives not be eliminated from consideration. The follow paragraphs provide additional discussion of the alternatives. Given the conceptual nature of this evaluation only preliminary conclusions could be drawn regarding a recommended recycled water alternative.

**Figure 5-14: Estimated Annual Unit Cost and Associated Unit Benefits**



The water sale alternative is the most cost effective (lowest unit cost) recycled water project and has the highest potential benefit. The project would result in beneficial use of recycled water which is a reliable supply. Environmental benefit may be realized if diversions of San Joaquin River water are reduced. Wastewater disposal capacity would be increased with the use of recycled water. This project would require an agreement with an ID for use of the water. From an implementation perspective, this project is expected to require significant work and negotiation with an ID. In conjunction with this project, recycled water may also be used in the SJRNWR which would use the supply for wetlands enhancement.

A recycled water project at the primary treatment plant would serve urban customers. This would have water supply and wastewater benefits. The quantity of recycled water produced would be significantly less than the envisioned water sale alternative. However, this project would be a good project to demonstrate the beneficial use of recycled water and build community support for a larger project. An urban project may have benefits equal to project costs depending on future wastewater needs.

The Ripon and Salida Satellite Treatment Plant Alternative is a representative example of the type of project that could be implemented by groups of stakeholders. The concept would provide recycled water to the City of Modesto CPD's and is therefore contingent on these future developments. Markets for other groups of stakeholders have not been identified. This alternative would result in water and wastewater disposal benefits. Unit costs for the alternative are relatively high as primary, secondary, and disposal upgrades would be required in addition to tertiary and disinfection processes.

The Beard Satellite Treatment Plant Alternative has the highest unit cost as currently defined. The high cost is related to the assumed need for RO treatment. As previously discussed, the Beard Satellite Treatment Alternative is envisioned to be a joint project with a cogeneration facility. The cogeneration facility is only a conceptual idea that has yet to formally be investigated. Although it has a high unit cost, it is recommended that the City evaluate the alternative if the City moves forward with a cogeneration

investigation. The Beard Satellite Alternative would provide recycled water for the cogeneration facility, which would conserve the use of other water supplies. This project would have both water and wastewater benefits. This project would only operate seasonally as the canneries operate from July to September. This short operating season could limit the practicality of the Beard Satellite Alternative.

Considering the number of unknowns and interests that need to be investigated for each of the alternatives, the Project Team and City of Modesto staff identified a recommended strategy for continuing work on the Project. Based on the alternative costs, stakeholder workshops, benefits, implementability, and other considerations, a four phased approach was identified to cover near-term, mid-term, and long-term opportunities. The four phased approach is identified in the following recommended strategy section. The next section also identifies the implementation strategy and steps, a proposed schedule, and funding opportunities for the project.

## 6 Recommended Strategy

This section identifies a recommended strategy for the Northern San Joaquin Valley Water Reclamation Project. Based on the benefits and the ability to implement each of the alternatives described in Section 5, and the goals and objectives for the project, it was recognized that implementation of several alternatives may be the preferred strategy. It is also recognized that additional investigations and evaluations are necessary to develop the details of each alternative and to obtain final stakeholder commitments. With these factors in mind, a four phased approach was developed to continue planning level evaluations of the most promising alternatives.

This approach was developed through discussions with the City of Modesto staff with the goal of evaluating the near-term, mid-term, and long-term recycled water projects need to meet the interests and goals of the City, stakeholders, and the region. This section includes an implementation strategy that identifies the major tasks for pursuing the four phased approach.

This section is organized as follows:

- Description of the Four Phased Approach
  - Phase 1 Urban Recycled Water at the City of Modesto Primary Treatment Plant
  - Phase 2 Regionalization Alternatives
    - Patterson Conveyance to Secondary Facility
    - Ripon, Salida, and Riverbank Satellite
  - Phase 3 Water Sale Alternative with an Irrigation District and SJRNWR
  - Phase 4 Regional Recycled Water Facility
    - Westlands Water District
    - South San Joaquin Valley
- Funding Capabilities/Opportunities
- Implementation Strategy

### 6.1 Description of Four Phased Approach

The four phased approach includes a near-term (next 5 years), mid-term (5 to 8 years), and long-term (8+ years) strategy for the City of Modesto's and interested stakeholder's potential recycled water development. Considering the future water use outlook in California, recycled water is expected to be an extremely valuable resource in the future. Because of this expected value, the goal of the four phased approach is to immediately being implementation of a recycled water project while maximizing the opportunity for recycled water development in the future. The region's potential recycled water is thought to be a valuable resource that will help to meet the overall needs in the San Joaquin Valley in the future.

In the near-term, construction of recycled water facilities at the City of Modesto's Primary Treatment Plant with distribution to the urban area would help to meet near-term disposal needs and offset the use of potable water. This will free up potable supplies to be used for other beneficial uses. In addition, the near-term project could also include conveyance of wastewater from committed stakeholders to the City of Modesto wastewater system.

In the mid-term, the City could pursue the remaining regional project opportunities with the stakeholders that have expressed interest in a satellite alternatives or conveyance of wastewater to the City of Modesto WWTP's. Also in the mid-term, it is recommended that the City pursue a water sale/transfer project with an irrigation district and the San Joaquin River National Wildlife Refuge (managed by the USFWS).

In the long-term, other stakeholders like Turlock and Manteca expressed interest in a larger regional project for wastewater treatment and/or reclamation. Long-term recycled water market opportunities may include water sales/transfers with Westlands WD or other San Joaquin Valley water districts.

Identification of funding opportunities and securing funding for the project will be a key factor in the cost feasibility for each of the projects. Funding opportunities are identified in Section 6.6.

## **6.2 Phase 1 – Urban Recycled Water at the Primary Treatment Plant**

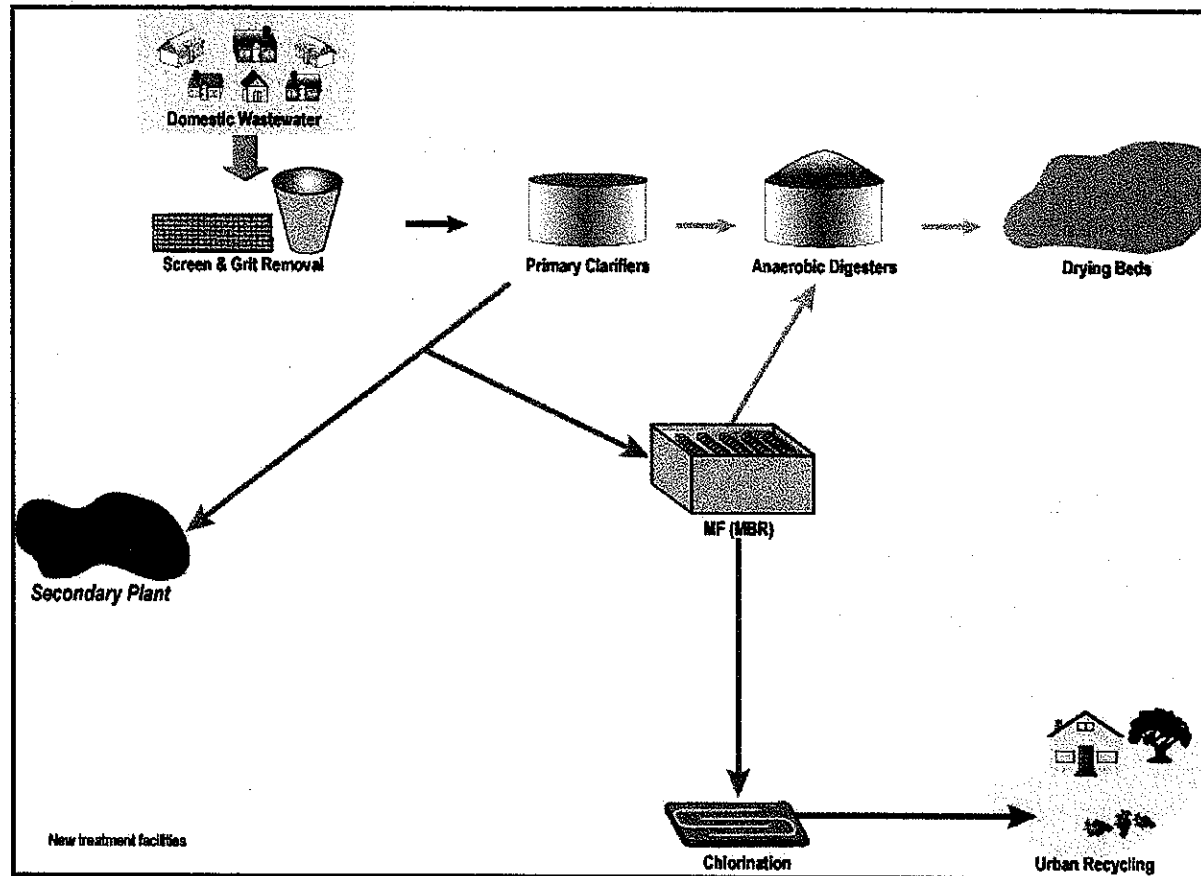
This near-term project would include construction of recycled water facilities at the Primary Treatment Plant and distribution infrastructure. The goal of this project is to serve a summer time flow between 6 and 10 mgd and demonstrate the safe and effective use of recycled water. Conceptually, treatment would need to include secondary, tertiary, and disinfection facilities. The project would serve urban market customers including golf courses, parks, school yards, industrial users, and the new developments (CPDs). Recycled water use in the CPDs service area would be for landscape irrigation, toilet flushing, and other non-potable uses.

A 6 to 10 mgd recycled water project would produce approximately 3,180 to 5,360 AF annually. This would benefit the City's water supply and wastewater disposal capacity. However, this level of use is not, by itself, considered the long-term disposal solution.

In addition, the near-term project could also include conveyance of wastewater from committed stakeholders to the City of Modesto wastewater system. One example is conveyance of the City of Patterson wastewater flows to the City of Modesto treatment facilities. For simplicity, this option is described in greater detail in the mid-term/Phase 2 Regionalization Alternatives in Section 6.3.

Figure 6-1 shows the schematic of the recycled water production at the Primary Treatment Plant with distribution to urban customers.

**Figure 6-1: Schematic of the Recycled Water at the Primary Treatment Plant**



Implementation of this project would include public outreach efforts, a market assurance investigation, regulatory permitting with the RWQCB and DHS, treatment pilot testing, and various funding tasks. Additional planning level evaluations should be completed to refine treatment facilities, design capacities, and distribution pipeline alignments. A funding strategy should be developed to pursue grants and loans as well as analyze the local funding mechanisms and constraints.

Meetings with the parks department, school districts, and various industrial users will be needed to develop water quality and quantity criteria, as well as identification of the specific locations of connection to the recycled water distribution system. The City will also need to hold workshops and outreach efforts with the public and local leaders to gain support for the project and reinforce safety, health, and public acceptance of recycled water. Support from local legislators, environmental groups, and the local irrigation districts will help to garner public support for the project.

It is expected that infrastructure for recycled water use in the CPDs areas would be constructed by developers. The City of Modesto should develop and implement new development requirements that mandate construction of dual plumbed systems which will facilitate recycled water use for landscape irrigation.

The project will also require environmental compliance with the California Environmental Quality Act (CEQA) to assess the environmental impacts of the project. Environmental compliance with the Federal National Environmental Policy Act (NEPA) may also be required if federal funding is pursued. Design of

the project could commence during the environmental process with the final design incorporating any mitigation measures outline in the CEQA and NEPA documents. The design process will also consist of applying for and securing permits for construction.

### **6.3 Phase 2 – Regionalization Alternatives**

Based on the two Stakeholder workshops, regionalization options are of interest in the region. As part of this feasibility study, two regionalization options were explored including conveyance of wastewater to the City of Modesto WWTP's and development of satellite treatment and reclamation facilities with conveyance of recycled water to the City of Modesto service area. These options are only in a preliminary phase of development and will require additional input and correspondence with each stakeholder to identify interests and goals. Cost share agreements for these evaluations should be developed to initiate work on these options. Memoranda of Understanding (MOU) or other agreements could be developed with each stakeholder to layout project goals, and project cost share.

#### **6.3.1 Conveyance of Wastewater to City of Modesto**

Based on the second stakeholder workshop, the City of Patterson expressed interested in connecting to the City of Modesto secondary WWTP. It should be noted that this option is a regionalization of wastewater treatment and disposal and would only result in recycled water production if the City of Modesto implemented a reclamation facility at the secondary WWTP. This option would include construction of a conveyance pipeline from the Patterson WWTP to the Modesto Secondary WWTP. A pump station would be constructed to pump wastewater to the Modesto WWTP.

This option would require an MOU or other agreement between the Cities of Modesto and Patterson for wastewater treatment and disposal. Additional planning level evaluations are necessary to refine the pipeline alignments, determine design flows, and identify design criteria. A cost evaluation would need to be completed to identify operations, treatment, and administrative costs of conveying flows to the City of Modesto.

#### **6.3.2 Development of Satellite Treatment and Reclamation Facilities**

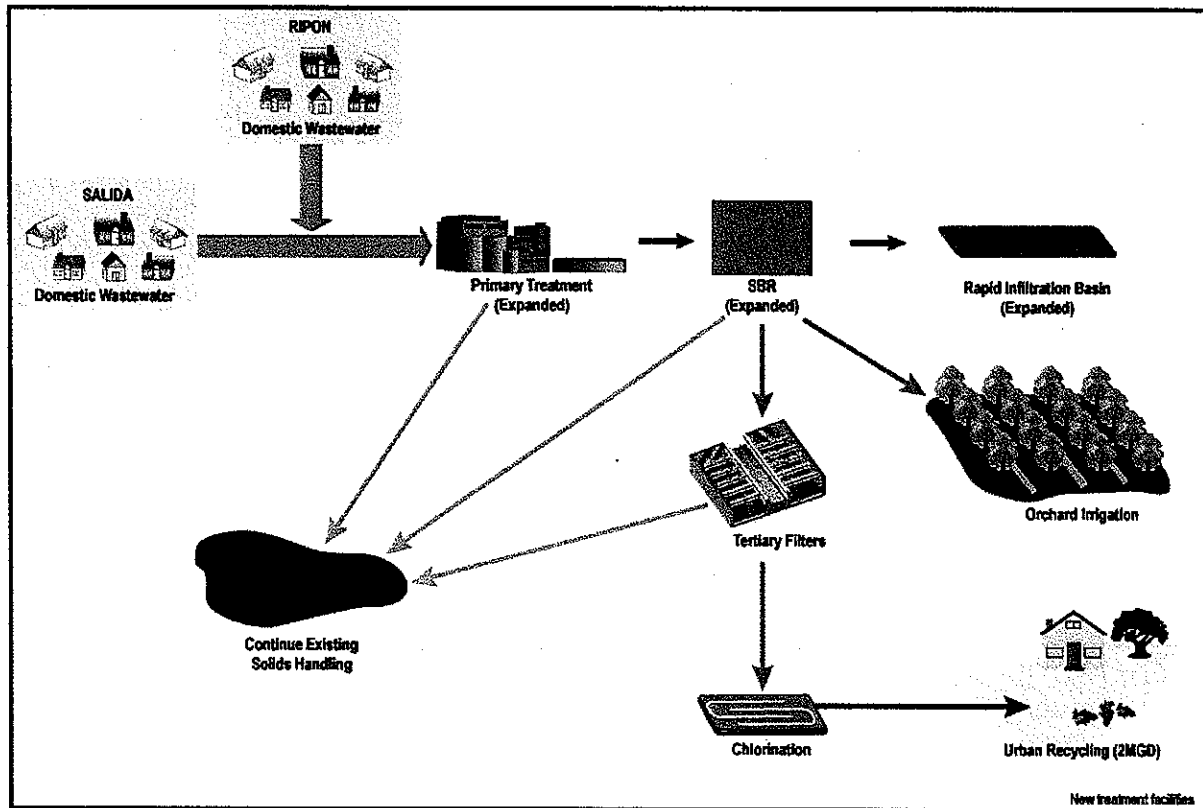
The Cities of Ripon, Salida, and Escalon have expressed interest in a joint project for disposal and/or treatment of wastewater. One potential option is to develop a satellite reclamation facility to produce recycled water. Conceptually, it is envisioned that one of the existing WWTP's would be the site of an expanded primary and secondary facility with a new reclamation facility. The Cities of Ripon, Salida, and Escalon have existing average flows of 1.1, 1.2, and 0.8 mgd respectively. Wastewater from the existing WWTP's would be pumped to a single regional treatment and reclamation facility.

The new reclamation facilities would include filtration and disinfection processes to produce Title 22 - disinfected tertiary recycled water. The potential market opportunity for this option would be urban customers in the City of Modesto service area. Near the Ripon and Salida areas, the City of Modesto has several planned CPDs. Salida also has an agreement to supply a local grower with recycled water. At this time the quantity and quality that is required for the agricultural irrigation is unknown. Recycled water in the CPDs would be used for landscape irrigation and other non-potable urban uses.

This alternative is expected to have cost sharing benefits associated with operations and maintenance, administration, and capital improvements. The project would conserve other water supplies that could be used for other beneficial uses.

Figure 6-2 shows the schematic of the Ripon and Salida Satellite Alternative that was evaluated in Section 5. This concept could be expanded upon to include Escalon. Alternatively, Escalon could team with another stakeholder to develop another satellite project. The next phase of the project should work to assess and further define concepts that meet the interests and needs of these stakeholders.

**Figure 6-2: Schematic of the Ripon and Salida Satellite Treatment Option**



The next step for the Phase 2 projects is to develop agreements with the interested parties to pursue additional studies, funding options, and cost sharing opportunities. Additional planning level evaluations should include a more detailed market assessment, a facility plan, and identification of design criteria, stakeholder goals, and future needs. User agreements between the stakeholders and the City of Modesto would need to be developed to outline operations, maintenance, and administration of the project.

It is expected that infrastructure for recycled water use in the CPDs areas would be constructed by developers. Therefore, it is recommended that the City of Modesto develop requirements for the installation of recycled water infrastructure for the project. The City and stakeholders will need to sponsor and hold workshops and outreach efforts with the public and developers to gain support for the project. Support from community leaders, local legislators, environmental groups, and the local irrigation districts will help to garner support for the project.

Implementation tasks should also include coordination with the RWQCB and DHS to track regulatory developments and the latest thinking associated with recycled water use. Recycled water use would require a reclamation permit from the Central Coast RWQCB.

The project would also require environmental compliance with the CEQA and NEPA if federal funding is pursued. Design of the project could commence during the environmental process with the final design incorporating any mitigation measures outlined in the CEQA and NEPA documents. The design process will also consist of applying for and securing permits for construction.

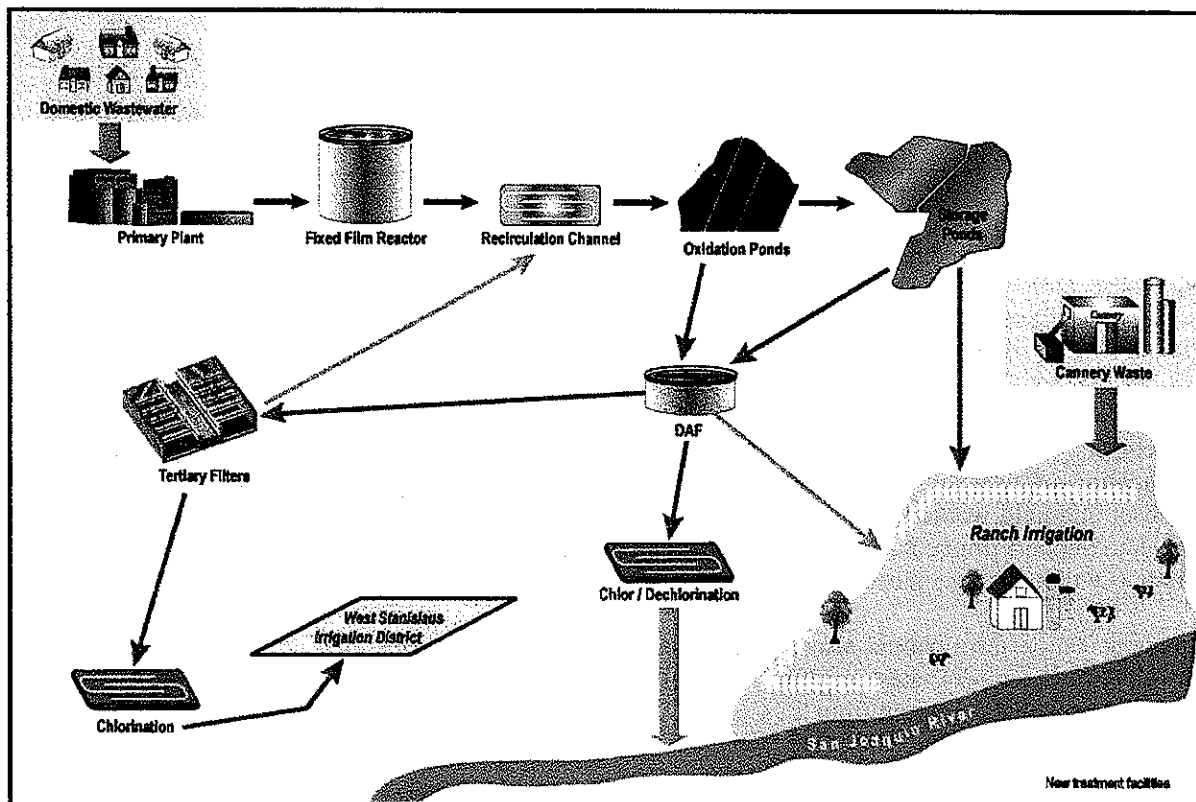
## 6.4 Phase 3 – Water Sale to an Irrigation District and SJRNWR

This project would include construction of recycled water facilities at the Secondary Treatment Plant and transmission infrastructure to convey recycled water to an irrigation district and/or SJRNWR. The goal of this project is to provide summer time supply to an irrigation district and fall and winter time flow to the SJRNWR. The irrigation district and the SJRNWR share a common diversion channel off the San Joaquin River for each of their supplies. The irrigation district has rights to the San Joaquin River water that would be augmented through implementation of this project providing a benefit to CALFED and the San Joaquin/Sacramento Delta. The USFWS is in the process of restoring wetlands in the SJRNWR and proposes to utilize San Joaquin River water to provide flow to the wetlands.

Conceptually, treatment facilities would include tertiary treatment and disinfection facilities. Based on preliminary discussions, recycled water use could be near 20,000 AFY. The flow to the irrigation district would be used for agricultural activities during the irrigation season. Demand for recycled water flow in the SJRNWR would be for environmental use (wetland enhancement) in the fall and winter. The potential demand and desired water quality of recycled water in the SJRNWR has not been identified to date. Additional investigations with the USFWS are necessary in order to identify required criteria.

Figure 6-3 shows the schematic of the Water Sale Alternative that was evaluated in Section 5.

Figure 6-3: Schematic of Water Sale



Implementation of this project will require an agreement between the City of Modesto and an irrigation district. The City and the irrigation district will need to negotiate facility operations, water delivery, project costs, and other details. A teaming arrangement should be developed to pursue project development, funding and environmental compliance. Additional planning level evaluations including coordination with an irrigation district should be completed to refine treatment facilities, design flows, and blending facilities. Use of recycled water in the SJRNWR would require coordination and an agreement with the USFWS. Other implementation tasks include public/grower outreach efforts in the irrigation district service area, a market assurance investigation, regulatory permitting with the RWQCB and DHS, treatment process pilot testing, and funding evaluations.

The project will also require environmental compliance with the CEQA and NEPA if federal funding is pursued. NEPA compliance will likely be required for any delivery of water to the SJRNWR. Design of the project could commence during the environmental process with the final design incorporating mitigation measure outline in the CEQA and NEPA documents. The design process will also consist of applying for and securing permits for construction.

## **6.5 Phase 4 – Regional Water Recycling Facility**

In the long-term, the Cities of Turlock and Manteca have expressed interest in a regional treatment facility or disposal strategy. Potential options include conveyance of raw, partially treated, or disinfected tertiary wastewater to a central location for additional treatment or distribution. The Cities of Turlock and Manteca are thought to primarily be interested in a project to address future wastewater flows. Disinfected tertiary recycled water is assumed to be the minimum treatment required.

The value of recycled water is expected to increase in the future as water demands continue to increase. As the value of recycled water increases, water sale opportunities with customers further away from Modesto may be more viable. In addition, expanding urban use and/or groundwater recharge could become economically feasible.

Additional discussions with Turlock and Manteca are needed to identify specific interests, goals, and objectives. Treatment and disposal needs will also need to be discussed and identified.

Water sale is envisioned to be the primary market option for the long-term recycled water use. One option for delivery of recycled water is via the Delta Mendota Canal (DMC) for conveyance to WWD or other agencies in the southern San Joaquin Valley region. Use of the DMC would allow a significant quantity of recycled water to be used beneficially. The anticipated market for recycled water would be for agricultural irrigation as the DMC serves multiple agricultural agencies and districts.

Use of the DMC to transport recycled water is expected to be a potential issue as the City of Modesto is located upstream of the O' Neill Forebay which diverts water into San Luis Reservoir. The San Luis Reservoir is a joint facility between the State Water Project and the USBR and provides agricultural, municipal, and industrial supply. Santa Clara Valley Water District (SCVWD), Metropolitan Water District (MWD), and San Benito County Water District (SBCWD) use water supplies from San Luis Reservoir for municipal and industrial purposes, and may object to use of the DMC for conveyance of recycled water. To date these districts have yet to be contacted to discuss a potential project.

A conveyance pipeline would need to be constructed to deliver recycled water to the DMC. The envisioned conveyance pipeline under Phase 3 could be extended to deliver water to the DMC. Facility and future operational considerations should be evaluated in the Phase 3 implementation process.

Implementation of this project would require agreements with a number of stakeholders including the USBR, San Luis Delta Mendota Water Authority, WWD and other water districts/agencies. It may be necessary to undertake detailed State Water Project and CVP operations analyses to determine the impacts and limitations of recycled water delivery utilizing the DMC. Additional planning level evaluations, including coordination with stakeholders, should be completed to refine water quality requirements, design flows, and other criteria. Other general implementation tasks include public/grower outreach efforts, a market assurance investigation, regulatory permitting with the RWQCB and DHS, treatment process pilot testing, and funding evaluations.

A teaming agreement should be developed with interested parties for continued evaluation of recycled water conveyance in the DMC to a south San Joaquin Valley district. This would outline cost share, project objectives, and other teaming details.

This project would require environmental compliance with the CEQA and NEPA would also be required since use of the DMC for recycled water delivery would be a discretionary action on the part of the Bureau of Reclamation. Design of the project could commence during the environmental process with the final design incorporating mitigation measure outline in the CEQA and NEPA documents. The design process will also consist of applying for and securing permits for construction.

The Phase 4 project has two primary drivers including 1) long-term regional wastewater disposal needs and 2) meeting future water supply needs in California. Long-term disposal needs will require treatment and disposal upgrades while future water supply needs will drive the economics for water sale opportunities.

## 6.6 Estimated Cost

The concept level estimated cost of the Phase 1-3 projects are summarized in Table 6-1. The cost of the Phase 4 project has not been developed as details and costs of the alternative could vary significantly depending on the interests of the future stakeholders. Capital costs for the project were annualized assuming a 30-year recovery period and an interest rate of 6%. Estimated costs are in summer 2003 dollars.

**Table 6-1: Estimated Cost Summary of Phase 1, 2, and 3**

Project Element	Estimated Cost			
	Phase 1 <sup>a</sup>	Phase 2 <sup>b</sup>	Phase 3 <sup>c</sup>	Total
<b>Raw Construction Costs</b>	<b>\$34,556,000</b>	<b>\$12,309,000</b>	<b>\$68,995,000</b>	<b>\$115,860,000</b>
Construction Contingency (50%)	\$17,278,000	\$6,155,000	\$34,498,000	\$57,931,000
<b>Total Construction Cost</b>	<b>\$51,834,000</b>	<b>\$18,464,000</b>	<b>\$103,493,000</b>	<b>\$173,791,000</b>
Right of Way	\$49,000	\$15,000	\$48,000	\$112,000
Engr, Legal, Admin, and Environ. (30%)	\$15,550,000	\$5,539,000	\$31,048,000	\$52,137,000
<b>Total Capital Cost</b>	<b>\$67,433,000</b>	<b>\$24,018,000</b>	<b>\$134,589,000</b>	<b>\$226,040,000</b>
Annualized Capital	\$4,899,000	\$1,745,000	\$9,778,000	\$16,422,000
Combined Annual O&M	\$2,823,000	\$609,000	\$4,691,000	\$8,123,000
<b>Total Annualized Cost</b>	<b>\$7,722,000</b>	<b>\$2,354,000</b>	<b>\$14,469,000</b>	<b>\$24,545,000</b>
Annual Yield (AFY)	5,360	1,060	20,000	26,420
<b>Unit Cost</b>	<b>\$1,440</b>	<b>\$2,220</b>	<b>\$720</b>	<b>\$930</b>

Footnotes:

- Estimated cost for the 10 MGD Urban Alternative at the Primary Treatment Plant.
- Estimated cost for the Ripon and Salida Satellite Alternative. Does not include costs associated with Escalon joining the project.

- c. Estimated cost for the Water Sale Alternative to the irrigation district.

The unit cost of Phase 1-3 is approximately \$930 per acre foot which is below the estimated costs of the No Project Alternative of \$1,090 per acre foot assuming RO treatment is required in the future for wastewater disposal.

## **6.7 Funding Capabilities/Opportunities**

Projects can be funded on the local level through municipal bonds that can be repaid through utility rates (increases in water or sewer rates), impact fees, or special assessments. The regional and/or water sale aspects of the water recycling projects would also provide an opportunity for a joint project. This may result in a cost share opportunity for the City, with one or more stakeholders or a water importer.

Funding for a project may also be available from Federal and State agencies. State and Federal grants and loans from the following agencies may apply to this project:

- State Water Resources Control Board (SWRCB)
- California Department of Water Resources (DWR)
- U.S. Bureau of Reclamation (USBR)

Funds are available for various project stages from feasibility studies to design and construction. The following sections highlight potential funding sources. Potential revenue sources are then discussed followed by a preliminary funding strategy for the next phase of a project.

### **6.7.1 Funding Sources**

The primary focus of this section is to identify grant and loan opportunities. Local funding mechanisms, stakeholder funding, and water sale funding will be evaluated following the selection of a recommended alternative. It should be noted that additional grant funding for projects will likely become available as new State Propositions or Federal Acts are passed. The construction grant funds available under current State Propositions may not be available by the time the City is prepared to construct a project. However, it is anticipated that future State Propositions would be passed by California voters that would continue to provide funding for recycled water and environmental projects. The following sections summarize current grant and loan programs.

#### **6.7.1.1 State Water Resources Control Board**

The SWRCB administers several grant and loan funds that may be applicable to a recycled water project. The applicability of a grant or loan is dependent on the associated benefits of the recommended water recycling project.

##### **Water Recycling Facilities Planning Grant (WRFPG)**

This grant program provides up to 50% of the cost (up to \$75,000) to fund feasibility studies for projects that can lead directly to the design and construction of water recycling projects using treated municipal wastewater. Under this program the City was granted \$75,000 for the completion of this feasibility study. The funds for this grant program under Proposition 204 have been completely allocated. However, as an example of on-going funding opportunities, additional grant funds for water recycling facility plans are available under Proposition 50. To date, the SWRCB has yet to develop guideline for dispersing Proposition 50 funds available for facilities planning. The SWRCB is in the process of developing the guidelines, and preliminary discussions have indicated a potential for the SWRCB to fund the next phase of the Northern San Joaquin Valley Regional Recycled Water Project.

**Proposition 50 - Chapter 5 (Clean Water and Water Quality)**

Approved by California voters in the November 2002 elections, funds allocated by Proposition 50 will be subject to appropriation by the Legislature through the State budget process. Initial appropriations are expected in fiscal year 2003-04. The SWRCB is expected to have \$100 million under Chapter 5 (Clean Water and Water Quality) and at least \$250 million under Chapter 8 (Integrated Regional Water Management). Most of these new funds will likely be allocated as grants.

Chapter 8 (Integrated Regional Water Management) will provide \$250 million in grants for projects to "protect communities from drought, protect and improve water quality, and improve local water security by reducing dependence on imported water".

Proposition 50 funds are expected to be allocated over several fiscal years. The funds were initially expected to be obligated by 2005. However, based on discussions with the DWR staff, the funds may be obligated over a longer period. The funding program details are expected to be released by October 2003.

**State Revolving Fund (SRF)**

The SRF is a perpetual loan program that provides low interest loans to fund water recycling projects that exceed \$15 million, or are a cost-effective alternative in non-point source pollution control. Low interest loans are provided and are then repaid over a 20 year period. As the SRF is repaid the funds become available for other projects.

**Water Recycling Construction Program (Proposition 13)**

The Water Recycling Construction Program (formerly the Water Recycling Loan Program) provides low-interest loans and grants to local public agencies for the design and construction of water recycling facilities. The types of facilities include wastewater treatment, recycled water storage facilities, pump stations, and recycled water distribution pipelines. A funding application must include a facilities plan to document the need for the project, the alternatives that were analyzed, and the engineering, economic, financial, and institutional feasibility of the proposed facilities.

**6.7.1.2 California State Department of Water Resources**

The DWR administers grant and loan funding associated with legislation and several general obligation bond laws. These funds are targeted for water conservation and groundwater management purposes that could be linked with a recycled water project. The following sections identify both previous and present funding opportunities. Previous opportunities are summarized as funds may be available under future propositions.

**DWR Local Water Supply Project Feasibility Study Loans**

This program under Proposition 82 has an annual budget of \$2.0 million and each study is limited to a maximum loan amount of \$500,000. The feasibility studies should demonstrate whether a proposed project is feasible in its engineering, hydrologic/hydrogeologic, environmental, economic, and financial aspects. The results of a feasibility study should provide the data necessary to develop a complete construction loan application. A construction loan application may be obtained from the DWR as a guide in preparing the feasibility study work plan. An applicant may not simultaneously request loans for both a feasibility study and project construction for a single project under the Local Water Supply Project Loan program. The interest rate for these loans is equal to the State's interest rate on the general obligation bonds sold to finance the program, which are typically approximately one-half the rate available to local municipal agencies.

### **CALFED Proposition 50 Chapter 7**

CALFED is a joint effort by various State and Federal agencies to manage the Bay Delta. With the recent passage of Proposition 50, the CALFED Bay-Delta Program will have \$825 million in funds under Chapter 7 (CALFED Bay-Delta Program) for projects to develop and implement a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta System. The DWR will oversee the administration of these funds. CALFED is in the process of working with the DWR to establish criteria for the distribution of funds.

The potential water sale alternative could reduce demand for San Joaquin River water therefore providing a linkage to the goals of CALFED. This is seen as a potential major source of funding for delivery of recycled water.

### **Proposition 50 Chapter 6 (Contaminant and Salt Removal Technologies)**

The DWR is in the process of establishing new programs to administer these funds. Proposition 50 has \$100 million in grants allocated under Chapter 6 (Contaminant and Salt Removal Technologies) for desalination of ocean or brackish water projects, pilot/demonstration projects, and treatment of specified contaminants. This program will be a competitive grant program matching up to 50% of the project costs. Applicants have to provide the other 50% of the funding for the project using non-state fund sources.

### **6.7.1.3 United States Bureau of Reclamation**

The Bureau funds water recycling projects through Title XVI. This program allows the Bureau to provide funding for feasibility studies, environmental documentation, research and demonstration programs to test water reclamation and reuse technologies, and for construction of reuse projects. However, the program is restricted in that projects must be constructed and owned by a non-federal entity, as described in the "Guidelines for Preparing, Reviewing, and Processing Water Reclamation and Reuse Project Proposals Under Title XVI of Public Law 102-575, as Amended", prepared by the Bureau.

One approach to obtaining Title XVI funding is through a Congressional write-in to the federal budget. This approach relies upon the local Congressional representative to initiate the budget request through Congressional review and approval of the President's budget. This approach has been successful for other California entities, but requires a significant level of assistance in Washington D.C. Further, for all Title XVI projects, the funding stream is dependent upon the annual Congressional appropriations process.

The Bureau provides 25% of the funding to a maximum amount of \$20 million in the form of a grant, and the remaining 75% has to be provided from a non-federal source (the applicant). Congress authorizes the Bureau to fund projects.

Funding under Title XVI requires annual authorization by Congress as federal funds need to be incorporated into the annual federal budget. As with the funding for feasibility studies, appropriations can be obtained through the Congressional budget process.

### **6.7.2 Revenue Sources**

Revenue streams for the project will be highly depended on the projects that are implemented and the actual delivery of recycled water. With that noted, there are a variety of options for recovery of project costs including increases in water rates, water sales, special assessments, impact fees, and other structures. Recycled water is expected to have both water supply and wastewater benefits and revenue for a project could be collected through water rates and sewer rates.

Conceptually, if no recycled water project is implemented, wastewater treatment and disposal operations would likely need to be upgraded to meet future needs and regulatory requirements. The costs associated with these upgraded facilities and operations would likely be recovered through increases in sewer rates. Implementation of a recycled water project would include wastewater treatment upgrades to produce higher quality water and may eliminate or reduce the required disposal improvements. Therefore, a recycled water project should be viewed, at least partially, as an alternative wastewater treatment and disposal project. One funding scenario could include raising sewer rates to a similar level that would have been necessary under the no project alternative.

A recycled water project would free up potable water supplies allowing the water to be used for other uses. This would eliminate or defer the need to increase water supply capacity that would be necessary to meet increases in water use. If a recycled water project is not implemented, water supply capacity improvements would need to be implemented to meet future demand. The costs for these facilities would likely be recovered through connection/impact fees for new development. The recycled water facilities would replace or defer the need for water treatment plant upgrades therefore connection/impact fees associated with a water treatment plant upgrade could be used to recover cost for a recycled water project. The water rate for recycled water would likely be similar to the existing water rate for parks and school yard irrigation.

Water and sewer fees or rates required to recover the cost of a recycled water project would need to be competitive with other water supply or wastewater treatment and disposal alternatives. A more detailed financial analysis will need to be completed in the next phase as the elements and components of the recycled water project are refined.

### **6.7.3 Next Steps (Funding)**

Following completion of the feasibility study, it is anticipated that the City would need to complete facilities planning and environmental documentation steps in order to fully define the water recycling project. The City should pursue additional funding opportunities for this planning level work. During the completion of the facilities plan and environmental documentation, the City should pursue funding for design and construction.

As previously discussed, the City of Modesto secured \$75k in funding through the SWRCB Water Recycling Facilities Planning Grant program. Additional funding may be available from this same program for the planning work is necessary to fully evaluate the regional aspects of the project.

For the next phase, the City could also pursue additional funding through federal programs, including the USBR Title XVI program. The USBR may provide up to 50% funding for a Feasibility/Facility Planning Study as part of the federal Title XVI program. However, this program is more limited in terms of available money, and must be appropriated by Congress. Therefore, funding from this program would be retroactive for the Facilities Plan if funding is approved.

It should also be noted that significant portions of the new dollars provided by Proposition 50 will be coordinated by CALFED. Accordingly, benefits to CALFED should be considered when structuring projects for funding. The Water Sale Alternative with the irrigation district and SJRNWR has the potential to provide significant benefits to CALFED. CALFED funding should be pursued once the guidelines and application process are developed.

By the time a Northern San Joaquin Valley Recycled Water Project is be ready for design/construction, Proposition 13 funding is expected to be fully obligated. A significant portion of Proposition 50 funds

may also be obligated depending of the actual implementation schedule. However, new state bond initiatives are expected to replenish the Propositions 13 and 50 funds.

Pursuit of additional planning level funding should be led off by meeting with the SWRCB staff to clarify the importance and benefits of regionalization and water recycling in the Northern San Joaquin Valley area. Linking water recycling to regional benefits will be critical for securing of funding from the SWRCB. Similarly, meetings with CALFED staff should also be conducted to discuss the benefits of a project that would deliver recycled water to the irrigation district and/or the SJRNWR. For this project, linking water recycling to environmental benefits will be critical for securing funding from CALFED.

## **6.8 Implementation Strategy**

The recommended approach for implementing a recycled water project in the Northern San Joaquin Valley region is to complete a facilities planning phase followed by design and construction. Additional planning level work is needed to further refine the alternatives recommended as part of the Phased approach. The following sections identify potential tasks that may be included in the next phase. It is recognized that resources may require tasks to be completed in several phases.

### **6.8.1 Stakeholder Coordination**

The next phase of work should include continued coordination with stakeholders and refinement of the alternatives. It is recommended that teaming agreements or MOUs between the City and stakeholders be pursued to outline cost sharing for additional investigations and pursuit of funding. More detailed evaluations with stakeholders will need to be completed to identify specific interests and design criteria for a stakeholder project. Stakeholder input will be key for refining alternatives and meeting interests of all parties involved.

Development of MOUs or other agreements is assumed to require approval from the City and Stakeholder Councils or Boards. This task would also include stakeholder workshops to update the stakeholder group on the progress of the project.

### **6.8.2 Funding Strategy Development**

Pursuing additional funding for the project will be a key task for planning, design, and construction. It is recommended that a funding strategy be developed to pursue both Federal and State grant opportunities. Funding for the project may be the difference between a cost feasible project and one that is not financially viable. The City should meet with Local, State, and Federal Representatives to inform them of the project and gain support and assistance in pursuit of funding. Other potential funding tasks include meeting with Federal or State Agency fund administrators, completing funding applications, and retaining and coordinating with a lobbyist.

### **6.8.3 Detailed Market Analysis**

For the Phase 1 urban market, a detailed market analysis will need to be completed to detail water use, water quality needs, and to gain support for the project. Retrofit requirements will need to be identified for the design process. Meetings with the local school districts, the City parks department, golf courses, and potential industrial users will be necessary to refine the project needs and to reinforce the safety of recycled water. Operational needs and criteria for each customer will need to be defined. The detailed criteria will allow for evaluation of storage, pump stations, and other facilities. User agreements will need to be developed with each recycled water customer for market assurance. Alternatively, a

mandatory use ordinance could be developed. An ordinance could also include requirements for CPDs to construction dual plumbed systems to facilitate landscape irrigation with recycled water should a supply be available.

For the Phase 2 irrigation district and SJRNWR market, meetings with the potential agricultural customers and the USFWS will be needed to define water quantity and quality criteria. Operational criteria and needs will need to be discussed with the irrigation district and USFWS.

#### **6.8.4 Public Outreach Plan**

A public outreach plan should be developed and implemented to garner support for the project. The plan should include public mailings and notices, brochures, workshops, and other education material. Endorsement of the recycled water project from state and local representatives, environmental groups, and others will also be key for public support and funding. The plan would be developed with the City of Modesto and stakeholders to detail the steps for engaging with the public, representatives, and others.

#### **6.8.5 Treatment Technology Evaluation and Pilot Testing Plan**

From a treatment perspective, additional investigations will be necessary to characterize the wastewater and select appropriate treatment technologies to meet disinfected tertiary Title 22 requirements. Treatment requirements at the primary WWTP, secondary WWTP, and satellite facility would vary according to water quality. A treatment technologies evaluation pilot testing plan could be developed to layout the tasks necessary for evaluation treatment technologies. A water quality monitoring program would be implemented during the pilot tests.

Pilot testing may include pretreatment, filtration, and disinfection technologies. Potential pretreatment processes include the Actiflo and Densadeg systems. Filtration may include membrane filters or granular media filters. Disinfection processes could include chlorination or ultraviolet disinfection.

#### **6.8.6 Conveyance and Distribution Refinement Evaluation**

Conveyance and distribution alignments should be reevaluated based on the detailed input from stakeholders and recycled water customers. Environmental impacts should also be considered when alignments travel near or within habitats. For the distribution system, operations, pipeline sizing, and flow conditions could be evaluated with a water system computer model such as H2O Net.

#### **6.8.7 Recycled Water Facility Planning Study**

A Recycled Water Facility Planning Study Report should be drafted to document the new findings from the investigation and evaluations identified in the previous sections. Alternative concepts will be refined and estimated cost will be reevaluated. Treatment facilities will be laid out and preliminary pipeline alignments will be developed. Right of way needs will be identified. Preliminary operations plans will be developed and assessed with computer modeling. Required permits will be identified in conjunction with environmental documentation.

#### **6.8.8 Environmental Documentation**

Environmental compliance with the CEQA would be required prior to construction. Compliance with NEPA would be required for the project for federal funding or other federal approvals. In the next phase an environmental constraint analysis should be completed to gain a preliminary understanding of impacts associated with the potential components of the project. Communication with regulatory agencies

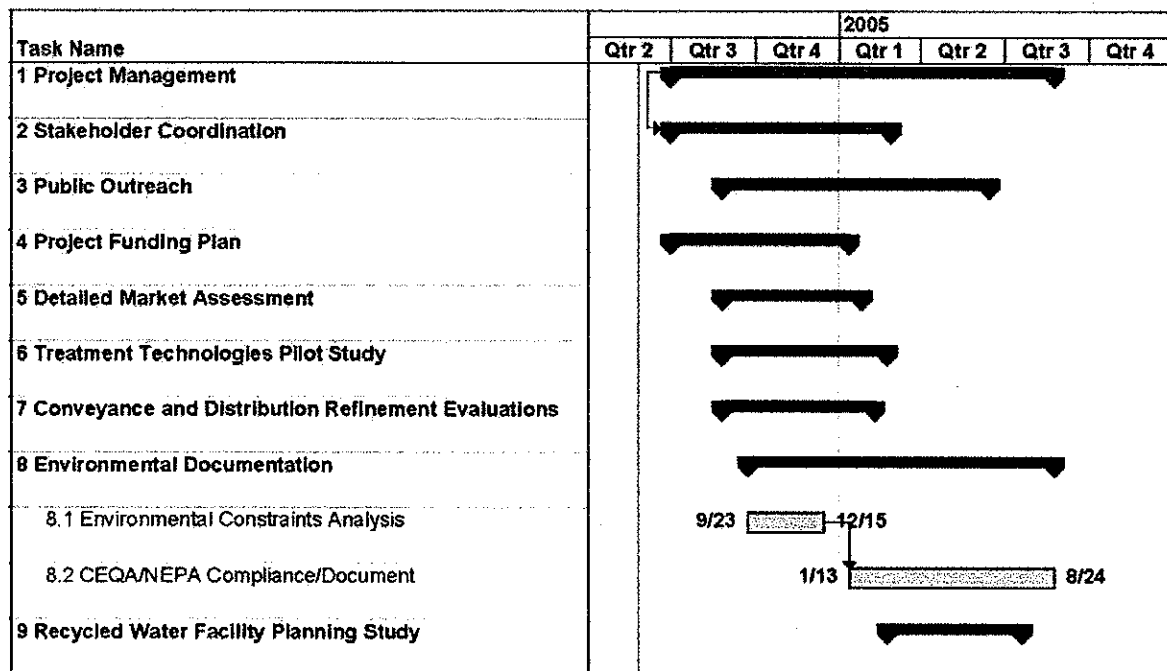
(RWQCB and DHS) should continue in order to assess the regulatory feasibility of the project components.

NEPA/CEQA compliance/documentation should be completed in conjunction with the facility planning study so that alternatives can be modified for environmental impacts and considerations.

### 6.8.9 Implementation Schedule

Figure 6-4 shows the implementation schedule for the next phase of planning work. Design and construction phases are not shown in the schedule but are expected to follow the completion of the Environmental Document and the Facility Plan Report. Design and construction phases will be dependent on project financing and may be a function of grant availability.

Figure 6-4: Implementation Schedule





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## CITY OF MODESTO

July 1, 2008

**TO:** Councilmembers

**FROM:** Nick Pinhey, Public Works Director

**SUBJECT:** Wastewater Master Plan Supplement

**CONTACT:** William Wong, Senior Civil Engineer, [wwong@modestogov.com](mailto:wwong@modestogov.com),  
(209) 571-5801

**RECOMMENDED ACTION:**

This report is an informational update as requested by the Finance Committee. No action is required.

A copy of the Wastewater Master Plan (WWMP) Supplement will be distributed at the July 1, 2008 Stakeholder's Meeting. The City will solicit comments to the WWMP Supplement at a follow-up meeting on July 17, 2008.

**BACKGROUND:**

Typically, municipal WWMPs are updated every five to seven years to incorporate additional growth, current operations, and new planning data. Having a current and comprehensive WWMP is a critical step in keeping the City ahead of the replacement requirements of an aging infrastructure system and the pressures of expanding urban growth.

The City Council, on January 27, 2004, by Resolution No. 2004-050, approved an agreement with Carollo Engineers, P.C. (Carollo), of Walnut Creek, California to update the City's WWMP, and it was completed and adopted in 2007. The 2007 WWMP was prepared using City-furnished population growth rates available from 2005-2006. In addition, the plan relied upon anticipated wastewater discharge permit conditions for the Jennings Road Secondary Treatment Facility based on several meetings and lengthy discussions with staff of the Regional Water Quality Control Board (RWQCB).

However, recent housing and resultant near-term population growth has slowed considerably in the last 12 months. In addition, the RWQCB issued a new tentative waste discharge order (TO) on January 15, 2008, with limits more restrictive than those indicated from previous communications. The TO included unprecedented limits for seasonal secondary effluent discharges into the San Joaquin River, especially ammonia limits. The RWQCB issued the City's new permit with the new limits on April 25, 2008.

The City Council, by Resolution 2008-187, on April 1, 2008, approved an agreement with Carollo to prepare a WWMP Supplement, due to Carollo's familiarity with the City's wastewater treatment facilities, as well as their ongoing work with the Phase 1A Tertiary

Treatment Facility and their current task of analyzing alternatives to meet new discharge permit requirements.

The WWMP Supplement was prepared to revise the City's strategic plan to meet these new discharge requirements and accommodate revised growth projections, reprioritize the capital improvement program and revise the projected cash flow curve, to be used by others, to update future wastewater rates.

The key new changes between the 2007 WWMP and the WWMP Supplement are summarized as follows:

**Population growth:** Population projections were revised based on current and historical trends. The build-out (2030) wastewater flows reduced from 41.5 million gallons per day (MGD) to 40.7 MGD.

**Ammonia:** This limit will require additional treatment (nitrification) to achieve compliance for the seasonal and year-round secondary effluent discharge. According to the City's records, the current effluent has consistently exceeded the new ammonia limit during the seasonal discharges since 2001. A more robust wastewater treatment process (activated sludge) is proposed to help the City meet these requirements.

**Compliance Schedule:** Based on the new Waste Discharge Requirements (WDRs), the City must meet the effluent limits by 2013. Therefore the City will need to accelerate its compliance date for BNR/tertiary from 2016 to 2013. As a result, portions of Phase 1B and Phase 2, from the 2007 WWMP, will be combined for new Phase 2. It is projected that the will need to construct an additional 18.4 mgd capacity plant to meet the discharge requirements by 2013.

**Revised Wastewater Treatment Improvement Phasing:** Related to the revised compliance schedule, non-critical Sutter Ave. improvements identified in Phase 1B of the 2007 WWMP will be deferred to 2018.

**Salinity Limits:** Salinity limits are addressed in the new WDR. The City will need to develop a plan to reduce salinity by 2022.

#### **REASONS FOR RECOMMENDATION:**

This report is for information only regarding the status of ongoing wastewater related projects.

#### **EXISTING POLICY / RELATIONSHIP TO STRATEGIC PLAN:**

As related to the Strategic Plan, this project supports the Council goal of having a properly planned, designed, and operating wastewater system. This action is also consistent with the Council goal of a well-functioning system that has sufficient capacity to meet the needs of all current and future economic growth.

**POLICY ALTERNATIVES:**

None.

**FISCAL IMPACTS:**

Although, this item is presented for information only, specific recommendations from the WWMP Supplement, if adopted by council, will have fiscal impacts.

**INTERDEPARTMENTAL COORDINATION:**

Ongoing coordination will continue between the Public Works and Finance Departments for funding future improvements.

**PUBLIC PARTICIPATION:**

There are meetings scheduled for July 1, 2008, to provide background and present findings and recommendations to interested parties, and a follow-up meeting on July 17, 2008, to receive feedback on the WWMP Supplement.

**ENVIRONMENTAL REVIEW:**

The preparation of the WWMP Supplement is not subject to CEQA. The City Council approved Resolution No. 2007-178 certifying the Final Master Environmental Impact Report (Master EIR) for the City of Modesto Wastewater Master Plan Update (SCH No. 2006052076) in accordance with the California Environmental Quality Act on March 13, 2007. Any capital projects not covered by the 2007 Master EIR may require additional environmental review.

**STEPS FOLLOWING APPROVAL:**

Revise the current financing program to fund the proposed improvements identified in the WWMP Supplement.

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City of Modesto  
Wastewater Treatment Master Plan  
Jennings Road Secondary Treatment Facility

**WASTEWATER TREATMENT  
MASTER PLAN SUPPLEMENT**

**EXECUTIVE SUMMARY**

**DRAFT**

June 2008



**WASTEWATER TREATMENT MASTER PLAN SUPPLEMENT**

**EXECUTIVE SUMMARY**

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## **WASTEWATER TREATMENT MASTER PLAN SUPPLEMENT EXECUTIVE SUMMARY**

### **1.0 INTRODUCTION**

The City of Modesto's (City) Wastewater Treatment Master Plan (Master Plan) was developed during the 2005 to 2006 timeframe and was formally adopted in March 2007. The plan was prepared using City-furnished population growth rates available at the time. In addition, the plan relied upon anticipated wastewater discharge permit conditions for the Jennings Road Secondary Treatment Facility based on several meetings and lengthy discussions with staff of the Regional Water Quality Control Board (RWQCB).

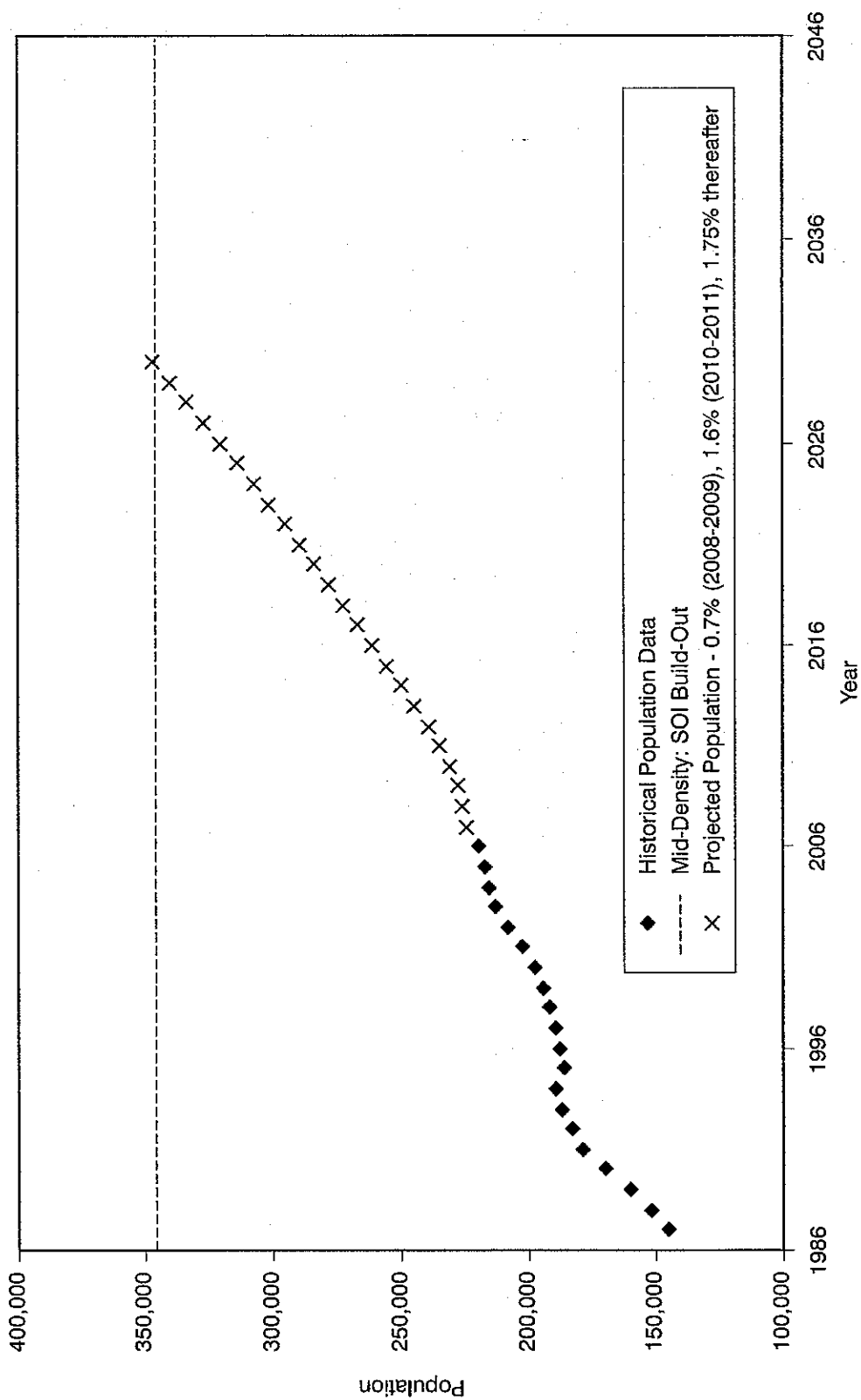
Housing and resultant near-term population growth has slowed considerably in the last 12 months. In addition, the RWQCB adopted a new waste discharge order on May 2, 2008. This order contains discharge limits for seasonal secondary effluent discharges to the San Joaquin River which are considerably more restrictive than those currently in effect and as indicated from previous communications with the RWQCB. Consequently, a Master Plan Supplement (Supplement) is required to address changes in population trends as well as the more restrictive waste discharge requirements.

Consistent with the premise of the original Master Plan, it is the City's desire to continue the practice of land application of segregated cannery process water. Detailed specific studies are anticipated to be required to verify appropriate land application rates and methodologies. Accordingly, the analysis presented herein focuses on the treatment and disposal of domestic wastewater flows.

### **2.0 POPULATION**

In the 2007 Master Plan, an annual population growth rate of 1.6 percent to 2011 and 1.75 percent thereafter, was used to project future flows. For this Supplement, it was assumed that the annual growth rate will be 0.7 percent for 2008 and 2011, 1.6 percent for 2010 and 2011, and 1.75 percent thereafter. This results in a projected 2030 population of 346,700 compared to 355,000 used in the 2007 Master Plan. Figure 1 is a plot of historic and updated population projections.

The near term growth rate of 0.7 percent per year was selected based on growth rates that occurred in the past economic decline in the mid-1990s. As indicated in Figure 1 after recovery from this downturn, historical annual population growth increased to about 2 percent over the next 10 years. Therefore, it appears reasonable that a similar pattern would occur when the housing market returns to more typical conditions.



**Figure 1**  
**PROJECTED POPULATION**  
**AT BUILDOUT OF SOI - MID-DENSITY**  
**WASTEWATER TREATMENT MASTER PLAN SUPPLEMENT**  
**EXECUTIVE SUMMARY**  
**CITY OF MODESTO**

### **3.0 PROJECTED FLOW AND WASTEWATER CHARACTERISTICS**

Projected wastewater flow has been revised based on the new population projection and applying the same unit flow of 117 gallons per capita per day (gpcd) used in the Master Plan. Figure 2 is a plot of the projected average annual flows presented in the Master Plan and those developed in this Supplement. As indicated, updated population projections result in a year 2030 flow of 40.7 million gallons per day (mgd) compared to the flow of 41.5 mgd used for the 2007 Master Plan.

Wastewater biochemical oxygen demand (BOD), total suspended solids (TSS), and ammonia concentrations have been updated as well based on the most recent data provided by the City. It is anticipated that wastewater characteristics in the future will be similar to existing conditions. Table 1 presents a summary of updated projected wastewater flow and loadings.

### **4.0 EFFLUENT LIMITATIONS AND DISCHARGE SPECIFICATIONS**

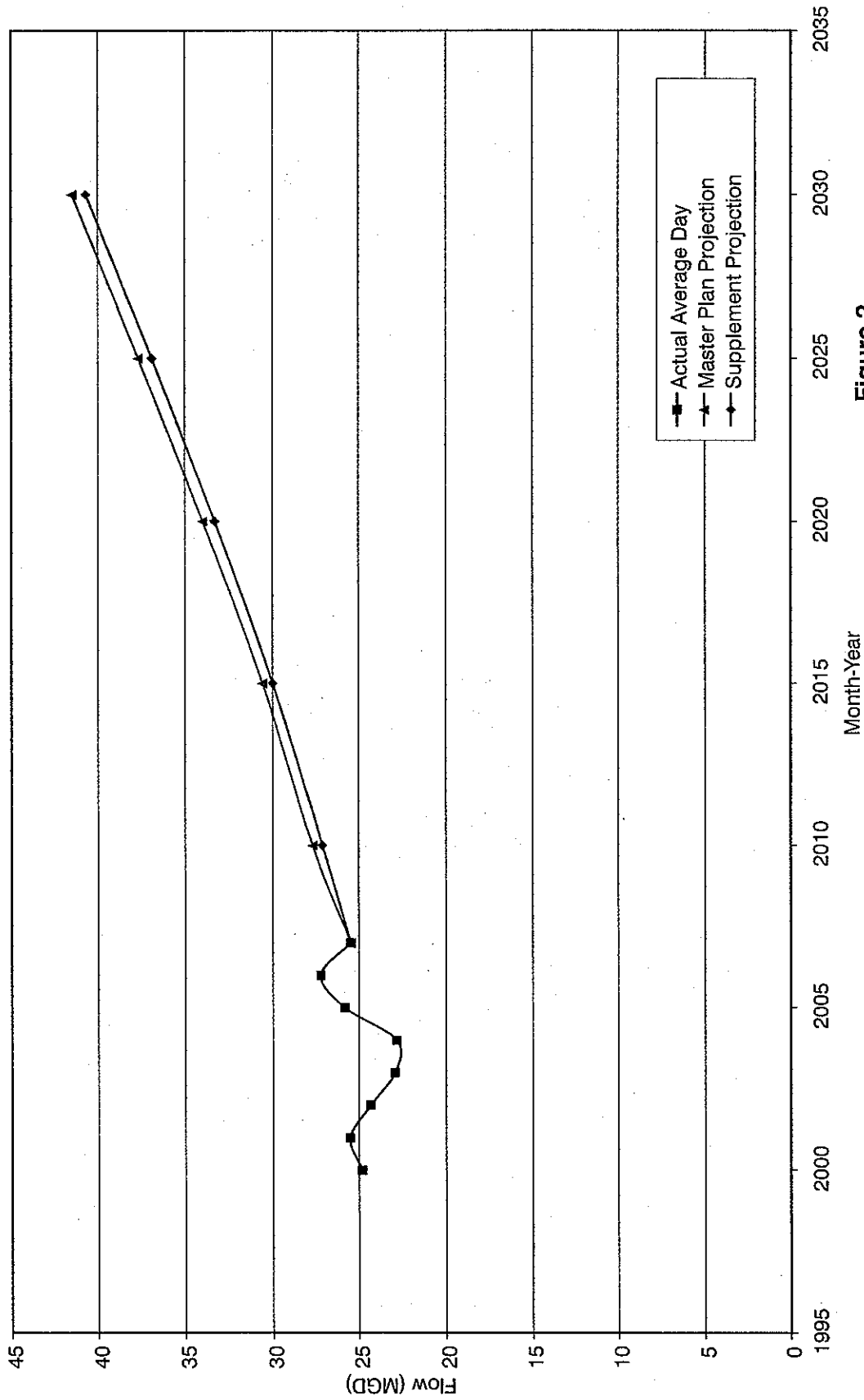
The RWQCB issued final Waste Discharge Requirements (WDRs) on May 2, 2008. The new WDR has impact on the Master Plan relative to both seasonal and year round river discharge. New limits for ammonia, metals, and electrical conductivity are of key concern. Table 2 presents a comparison of waste discharge requirements anticipated from previous communication with RWQCB staff and outlined in the 2007 Master Plan to the new requirements.

#### **4.1 Ammonia**

Existing discharge requirements that were in effect during development of the Master Plan allowed for a "floating" ammonia limit. The limit depended on the temperature and pH of the effluent. The ammonia limit ranged from 32.6 mg/L at a pH of 6.5, to 2.6 mg/L at a pH of 8.5. In contrast, the new discharge order has a fixed average monthly limit of 0.9 mg/L, regardless of pH or temperature. In order to achieve this limit the treatment process must be robust and controllable, especially in the winter months when temperatures are low and it is more difficult to nitrify.

##### **4.1.1 Seasonal Discharge**

Currently the City does not consistently remove ammonia from storage pond effluent during the discharge season. Ammonia levels typically rise in the winter months when biological activity slows due to low temperatures. Concentrations are also likely increasing in these months because the algae die off and release ammonia. The current pond system can adequately meet the previous pH and temperature-based floating limits for ammonia. However, additional treatment (nitrification) will be required to consistently remove ammonia in the winter.



**Figure 2**  
**PROJECTED FLOWS**  
 WASTEWATER TREATMENT MASTER PLAN SUPPLEMENT  
 EXECUTIVE SUMMARY  
 CITY OF MODESTO

<b>Table 1      Projected Flow and Loadings Wastewater Master Plan Supplement Executive Summary City of Modesto, California</b>						
	Year					
	2005-2007 Average	2010	2015	2020	2025	2030
<b>Population</b>		230,900	255,300	283,800	714,200	346,700
<b>Flows, mgd</b>						
Annual Average Flow (AAF)	26.2	27.1	30	33.3	36.9	40.7
Average Dry Weather Flow (ADWF)						
Peaking Factor	1.00	1.00	1.00	1.00	1.00	1.00
ADWF	26.2	27.1	30.0	33.3	36.9	40.7
Maximum Month Flow (MMF)						
Peaking Factor	1.11	1.11	1.11	1.11	1.11	1.11
MMF	29.1	30.1	33.3	37.0	41.0	45.2
Peak Dry Weather Flow (PDWF)						
Peaking Factor	1.42	1.42	1.42	1.42	1.42	1.42
PDWF	37.2	38.5	42.6	47.3	52.4	57.8
Peak Wet Weather Flow (PWWF)						
Peaking Factor	2.77	2.70	2.60	2.50	2.40	2.30
PWWF	71.7	73.2	78.0	83.3	88.6	93.6
<b>Influent to Sutter Ave. (Primary Plant)</b>						
<b>BOD</b>						
Concentration, mg/L	452	452	452	452	452	452
Average Annual Loading, lbs/day	98,800	102,200	113,100	125,500	139,100	153,400
Peaking Factor	1.23	1.23	1.23	1.23	1.23	1.23
Maximum Month Loading, lbs/day	121,500	125,700	139,100	154,400	171,100	188,700
<b>TSS</b>						
Concentration, mg/L	366	366	366	366	366	366
Average Annual Loading, lbs/day	80,000	82,700	91,600	101,600	112,600	124,200
Peaking Factor	1.46	1.46	1.46	1.46	1.46	1.46
Maximum Month Loading, lbs/day	116,800	120,700	133,700	148,300	164,400	181,300
<b>Ammonia</b>						
Concentration, mg/L	28	28	28	28	28	28
Average Annual Loading, lbs/day	6,100	6,300	7,000	7,800	8,600	9,500
Peaking Factor	1.46	1.46	1.46	1.46	1.46	1.46
Maximum Month Loading, lbs/day	8,900	9,200	10,200	11,400	12,600	13,900

<b>Table 1      Projected Flow and Loadings (Continued)</b> <b>Wastewater Master Plan Supplement</b> <b>Executive Summary</b> <b>City of Modesto, California</b>						
	Year					
	2005-2007 Average	2010	2015	2020	2025	2030
<b>Electrical Conductivity, <math>\mu</math>mhos/cm</b>						
Average Annual	1,250	1,250	1,250	1,250	1,250	1,250
Peaking Factor	1.19	1.19	1.19	1.19	1.19	1.19
Maximum Month	1,500	1,500	1,500	1,500	1,500	1,500
<b>Primary Effluent (Influent to Jennings Road Facility - Secondary Plant)</b>						
<b>BOD</b>						
Concentration, mg/L	272	272	272	272	272	272
Average Annual Loading, lbs/day	59,900	61,500	68,100	75,500	83,700	92,300
Peaking Factor	1.29	1.29	1.29	1.29	1.29	1.29
Maximum Month Loading, lbs/day	77,300	79,300	87,800	97,400	108,000	119,100
<b>TSS</b>						
Concentration, mg/L	112	112	112	112	112	112
Average Annual Loading, lbs/day	24,500	25,300	28,000	31,100	34,500	38,000
Peaking Factor	1.71	1.71	1.71	1.71	1.71	1.71
Maximum Month Loading, lbs/day	41,900	43,300	47,900	53,200	59,000	65,000
<b>Ammonia</b>						
Concentration, mg/L	27	27	27	27	27	27
Average Annual Loading, lbs/day	5,900	6,100	6,800	7,500	8,300	9,200
Peaking Factor	1.26	1.26	1.26	1.26	1.26	1.26
Maximum Month Loading, lbs/day	7,400	7,700	8,600	9,500	10,50	11,600

**Table 2 Comparison of New (2008) and 2007 Master Plan NPDES Permit Effluent Limitations  
Wastewater Treatment Master Plan Supplement  
Executive Summary  
City of Modesto, California**

Constituent	Averaging Period	Units	2007 Master Plan		New 2008 Limits	
			Seasonal Discharge Limits	Year Round Discharge Limits	Seasonal Discharge Limits	Year Round Discharge Limits
BOD <sub>5</sub>	Monthly Average	mg/L	30	10	30	10
	Weekly Average	mg/L	45	15	45	15
	Daily Maximum	mg/L	90	20	90	20
TSS	Monthly Average	mg/L	45	10	45	10
	Weekly Average	mg/L	60	15	60	15
	Daily Maximum	mg/L	105	20	105	20
Settleable Solids	Monthly Average	mL/L	0.1	--	--	--
	Daily Maximum	mL/L	0.2	--	--	--
	Monthly Average	mg/L	2.6 to 32.6 <sup>(1)</sup>	--	0.9	0.9
Ammonia	Daily Maximum	mg/L	--	8.0	2.1	2.1
	Daily Maximum	mg/L	0.02	0	--	--
	4-Day Average	mg/L	--	--	0.01	0.01
Chlorine Residual	1-Hour Average	mg/L	--	--	0.02	0.02
	7-Day Median	MPN/100 mL	23	2.2	23	2.2
	Daily Maximum	MPN/100 mL	500	23	240	23
Selenium (Total)	Monthly Average	µg/L	4.1	4.1	--	4.1
	Daily Maximum	µg/L	8.2	8.2	--	8.2
	Monthly Average	µg/L	4.5	4.5	--	--
Copper (Total)	Daily Maximum	µg/L	8.3	8.3	--	--
	Monthly Average	µg/L	10	10	--	--
	Daily Maximum	µg/L	15	15	--	23
Molybdenum	Monthly Average	µg/L	924	924	--	--
	Daily Maximum	µg/L	--	--	--	--
	Daily Maximum	µg/L	--	--	--	--
TDS	Daily Maximum	µg/L	--	--	--	--
	Daily Maximum	µg/L	--	--	--	--
	Daily Maximum	µg/L	--	--	--	--

**Table 2 Comparison of New (2008) and 2007 Master Plan NPDES Permit Effluent Limitations (Continued)**

**Wastewater Treatment Master Plan Supplement**

**Executive Summary**

**City of Modesto, California**

Constituent	Averaging Period	Units	2007 Master Plan		New 2008 Limits	
			Seasonal Discharge Limits	Year Round Discharge Limits	Seasonal Discharge Limits	Year Round Discharge Limits
EC	Daily Maximum	µmhos/cm	1,689	1,689	--	--
	Monthly Average	µmhos/cm	--	-	1,341 <sup>(2)</sup>	1,341 <sup>(2)</sup>
Chlorodibromomethane	Daily Maximum	µg/L	--	137.5	14.5	-- <sup>(3)</sup>
	Monthly Average	µg/L	--	--	5.0	-- <sup>(3)</sup>
Dichlorobromomethane	Daily Maximum	µg/L	70	70	25.7	-- <sup>(3)</sup>
	Monthly Average	µg/L	--	-- <sup>(1)</sup>	9.6	-- <sup>(3)</sup>
Carbon Tetrachloride	Annual Average	µg/L	--	--	4.5 <sup>(4)</sup>	4.5 <sup>(4)</sup>
	Daily Maximum	µg/L	--	--	8.9	--
Manganese	Annual Average	µg/L	--	--	50	50
Iron	Annual Average	µg/L	--	--	300	300
Nitrate	Monthly Average	mg/L	--	10	42	10
Nitrite	Monthly Average	mg/L	--	1	--	1
pH	Instantaneous	Std. Units	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5	6.5 - 8.5
Turbidity	Instantaneous	NTU	--	2	--	2
Flow	Average Daily	MGD	70	4.8	70	4.8
Aluminum	Annual Average	µg/L	200	200	200	200
	Daily Maximum	µg/L	--	--	--	750
	Monthly Average	µg/L	--	--	--	373

**Notes:**

(1) Calculated based on pH and temperature. Range is from 32.6 at pH 6.5 to 2.6 at pH 8.5.

(2) Interim limits.

(3) UV disinfection (which does not produce trihalomethanes) will be used for year-round discharge.

(4) Calculated value based on 20:1 dilution.

The cost of providing nitrification for the existing seasonal discharge is greater than that required to provide tertiary treatment and year round discharge. In addition, it is uncertain if future permits will continue to allow a seasonal secondary effluent discharge to the San Joaquin River. As a result of the new permit limit for ammonia, it is recommended that all river discharges be upgraded to tertiary treatment prior to the 2013 compliance date. This results in the elimination of seasonal river discharge 3 years earlier than that anticipated in the Master Plan.

#### **4.1.2 Year Round Discharge**

The Master Plan adopted the concept of utilizing the activated sludge process to provide nitrification and denitrification for year round discharge. The most cost-effective approach was to use the existing recirculation channel as a nitrification and denitrification reactor. However, due to its large volume with limited hydraulic and aeration control, it is unlikely that the recirculation channel will be a reliable process to meet the new, lower fixed ammonia limit, especially during the winter. Accordingly, the aeration basin configuration required to meet the new permit requirements for nitrification has been revised to include a plug-flow type reactor with fine bubble aeration. The reactor would consist of a new concrete tank with dividing walls.

#### **4.2 Metals**

The biological nutrient removal (BNR)/tertiary treatment required for year round discharge will not incorporate the facultative ponds which are effective in removing metals such as aluminum and iron. Therefore, the BNR/tertiary process must be capable of removing metals without using the facultative ponds. Pilot testing of a membrane bioreactor (MBR) indicate that metals limits can be achieved with the MBR process. Other tertiary processes, such as media filtration, may not be adequate to reduce metals levels to within standards.

#### **4.3 Salinity (as Electrical Conductivity)**

The interim limits for electrical conductivity (EC) can currently be met without additional treatment. These interim limits will be in effect until 2022 or 2026, depending on whether the year is a critically dry year or a normal year. For critically dry years, compliance is not required until 2026.

The City will need to plan for further treatment or develop new waste management practices to reduce salinity in river discharges. The future limits will require a 25 percent reduction in EC from current levels, for September 1 through March 31, and a 48 percent reduction for April 1 through August 31. The new WDRs require that the City submit a workplan and schedule for complying with the new EC limits by June 1, 2009.

Options to reduce EC include:

- **Source Control.** Reduce salinity by changing the potable water source from groundwater to surface water. The City has already converted 40 percent of its supply to surface water and is expected to convert 80 percent by 2010. In addition, the City will need to mandate salt reduction measures by industries and the public (such as banning the use of water softeners). The combined effect of these measures should be evaluated to estimate future effluent EC levels in the effluent.
- **Water Reuse.** The total salinity mass load to the river can be reduced by diverting some of the effluent to water reuse. However, the salinity concentration would not be reduced by this approach. The current WDR requires a concentration-based limit, so using the mass-based emission approach would be a change in policy that would need to be approved by the regulatory agencies.
- **Additional Treatment.** Additional treatment to reduce EC may be required. The most accepted salinity reduction process is reverse osmosis (RO). If the MBR process is utilized for BNR/tertiary treatment, it would be sufficient for pretreatment of the flow before reverse osmosis. Therefore, additional ultra filtration would not be required in subsequent phases if the MBR process is selected. Approximately 50 percent of the river discharge flow would require RO to meet future EC limits. For example, at 2030, the required RO capacity would be approximately 13 mgd, assuming the non-desalinated effluent would be blended with the RO effluent.

## **5.0 RECOMMENDED JENNINGS ROAD TREATMENT FACILITIES**

It is recommended that all seasonal secondary effluent discharge to the San Joaquin River be eliminated by the May 2013 compliance date required by the new permit. At that time, effluent quality would be upgraded to a tertiary level of treatment and river discharge would be year round. Secondary effluent and segregated cannery process water would continue to be utilized to irrigate the City's 3,876 acre ranch.

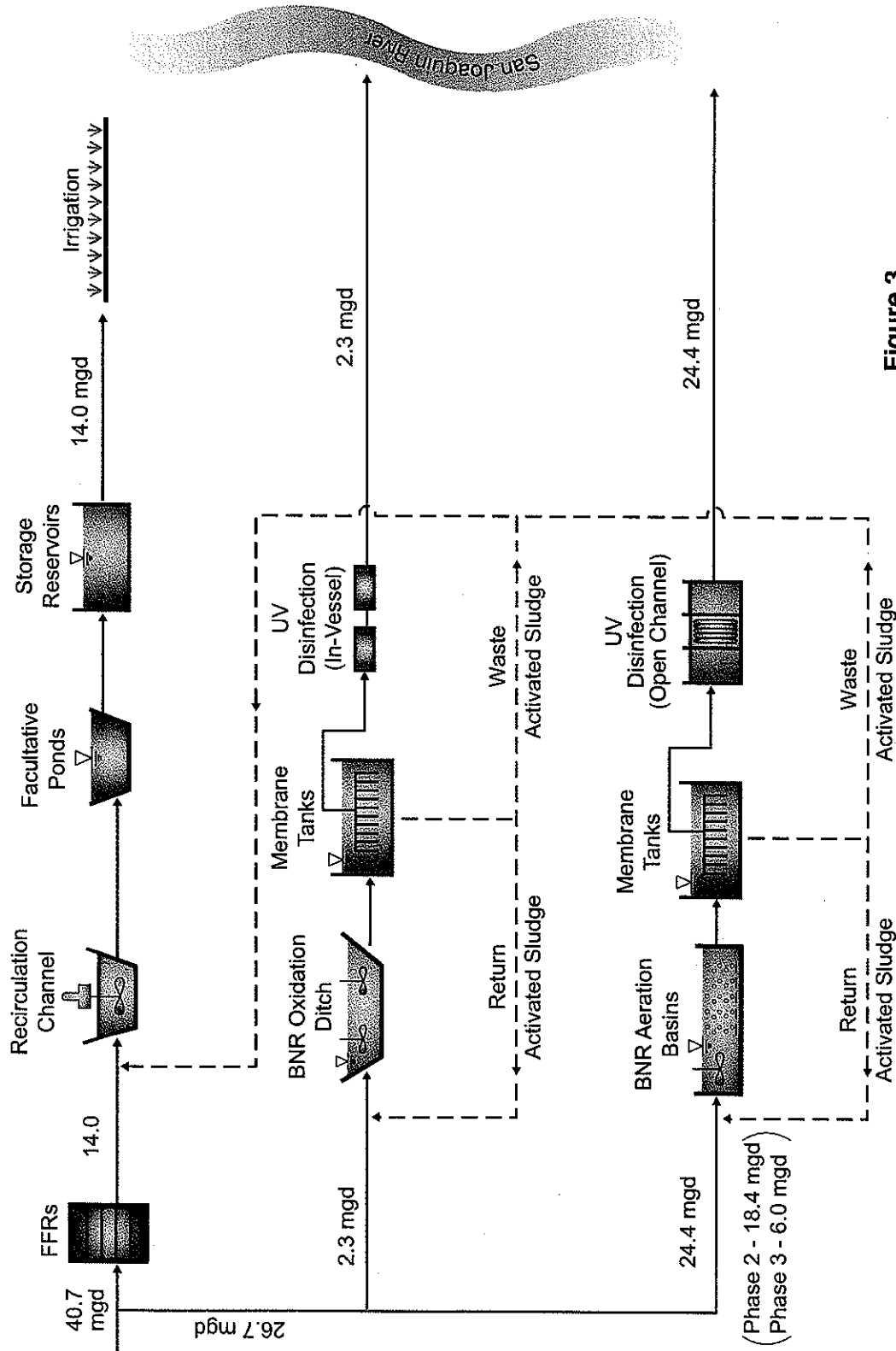
Upgraded treatment for year-round river discharge would consist of BNR with MBR. Treatment facilities would be constructed in three phases (1A, 2, and 3). Table 3 presents the capacity requirements for the various phases. The staging was developed based on a 10th percentile river flow, in accordance with the Master Plan.

The treatment process for subsequent phases would be similar to the Phase 1A process train. However, a plug flow type aeration basin would be used instead of the oxidation ditch reactor used for Phase 1A. The aeration basin would be aerated with fine bubble diffusers to provide increased efficiency. A blower building would also be required. Waste solids from the activated sludge process would be discharged to the recirculation channel and facultative ponds. Figures 3 and 4 show a flow schematic and conceptual layout, respectively of the proposed treatment facilities.

Table 3 Recommended Phasing Capacity Requirements Wastewater Treatment Master Plan Supplement Executive Summary City of Modesto, California													
	1	2	3	4	5=2+4	6=1-5	7	8	9	10=7+8+9	11=4+6+10	12=11-1	
	BNR/Tertiary Capacity Additions (mgd)												
	Secondary Effluent to River, without DAF mgd <sup>(2)</sup>			Secondary Effluent to River with DAF, mgd <sup>(1)</sup>	Total Disposal Capacity Existing Facilities (mgd)	Additional Disposal Capacity Required (mgd)	BNR/Tertiary Capacity			Total Disposal Capacity (mgd)	Excess Disposal Capacity Available (mgd)		
Year	Population	Average Annual Flow (mgd)	Secondary Effluent to Land (mgd) <sup>(3)</sup>				Phase 1A	Phase 2	Phase 3	BNR/Tertiary Capacity (mgd)	Total Disposal Capacity (mgd)	Excess Disposal Capacity Available (mgd)	
2006	219,900	26.1	14.0	10.2	10.2	24.2	1.9	-	-	-	0.0	24.2	-1.9
2008	229,500	26.5	14.0	10.2	13.2	27.2	-0.7	-	-	-	0.0	27.2	0.7
2009	233,200	26.7	14.0	10.2	13.2	27.2	-0.5	2.3	-	-	2.3	29.5	2.8
2011	240,500	27.5	14.0	10.2	13.2	27.2	0.3	2.3	-	-	2.3	29.5	2.0
2013	267,400	28.7	14.0	10.2	13.2	27.2	1.5	2.3	18.4	-	20.7	34.7	19.2
2013	267,400	28.7	14.0	0	-	14.0	14.7	2.3	18.4	-	20.7	34.7	6.0
2022	309,100	34.7	14.0	0	-	14.0	20.7	2.3	18.4	6.0	26.7	40.7	6.0
2026	328,300	37.6	14.0	0	-	14.0	23.6	2.3	18.4	6.0	26.7	40.7	3.1
2030	355,000	40.7	14.0	0	-	14.0	26.7	2.3	18.4	6.0	26.7	40.7	0.0
Notes:													
(1) DAF project adds the annual average equivalent of approximately 3.0 mgd. Assumes secondary effluent discharges to river and discontinued in 2013. DAF would no longer be used for effluent treatment and its use would be reassigned to waste-activated sludge thickening.													
(2) Based on lowest 10th percentile river flow assumption.													
(3) Includes evaporation/percolation loss of 5.9 mgd. Net effluent to land = 8.1 mgd.													

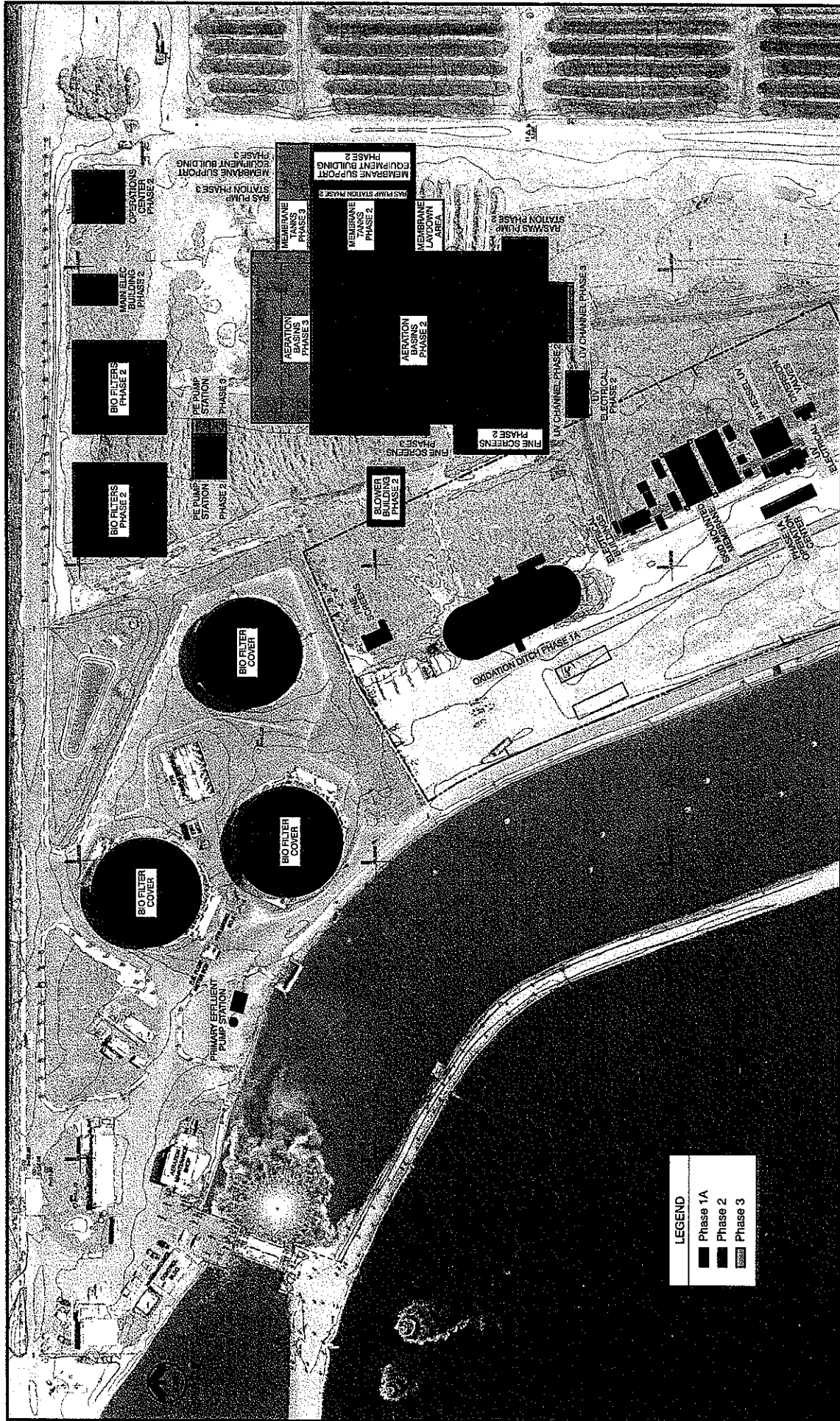
**Notes:**

- (1) DAF project adds the annual average equivalent of approximately 3.0 mgd. Assumes secondary effluent discharges to river and discontinued in 2013. DAF would no longer be used for effluent treatment and its use would be reassigned to waste-activated sludge thickening.
- (2) Based on lowest 10th percentile river flow assumption.
- (3) Includes evaporation/percolation loss of 5.9 mgd. Net effluent to land = 8.1 mgd.



**Figure 3**  
**RECOMMENDED JENNINGS ROAD TREATMENT SCHEMATIC**  
**WASTEWATER TREATMENT MASTER PLAN SUPPLEMENT**  
**EXECUTIVE SUMMARY**  
**CITY OF MODESTO**

LEGEND
40.7 - Denotes flow in mgd at 2030



**Figure 4**  
**RECOMMENDED JENNINGS ROAD CONCEPTUAL SITE LAYOUT**  
**WASTEWATER TREATMENT MASTER PLAN SUPPLEMENT**  
**EXECUTIVE SUMMARY**  
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## 5.1 Salinity Reduction

As described previously, the new WDRs require compliance with new EC (salinity) levels by the year 2022 for non-critically dry years and the year 2026 for critically dry years. The following describes the likely process, should treatment be required to achieve the new salinity limits.

For planning purposes, it was assumed that the salinity removal process would consist of reverse osmosis (RO). RO produces a brine concentrate that requires expensive disposal. Brine can be disposed of by using brine concentrators and evaporation ponds, or deep well injection (if permitted by regulatory agencies). To achieve the new EC limits, the design output flow for the RO system would be about 13 mgd by the year 2030 (at the end of Phase 3).

Planning-level capital cost estimates were prepared for the RO system and brine disposal facilities, based on the capacity required for Phase 3. The capital costs are summarized in Table 4. As indicated, the cost for the RO system would be approximately \$41.0 M in today's dollars. The cost for brine disposal would be approximately \$17.0 M for deep well injection or \$177.5 M for the brine concentration/ evaporation pond system. These costs are very preliminary and would need to be verified in a separate study.

<b>Table 4      Estimated Capital Costs for Reverse Osmosis Systems Wastewater Treatment Master Plan Supplement Executive Summary City of Modesto, California</b>			
Alternative	Design Flow (mgd)	Unit Process	June 2006 ENR
			Phase 2 2013 <sup>(1)</sup> \$M
1 Zero Liquid Discharge	26.7	RO System	41.0
		Brine Concentrator	94.2
		Brine Ponds	83.3
<b>Total</b>			<b>218.5</b>
2 Deep Well Injection	26.7	RO System	41.0
		Deep Well Injection	17.0
<b>Total</b>			<b>58.0</b>
<b>Notes:</b> (1) June 2006 dollars. ENR CCI = 8441. (2) Estimated capital costs include the following: estimating contingency - 30%, general conditions - 5%, contractor overhead and profit - 8%, engineering, legal and administrative - 20%, change order contingency - 5%.			

If RO and brine disposal is required in the future, it will have a major impact on the City's resources. It is likely that all municipal dischargers to the San Joaquin River will have similar limits, which could create a financial hardship for the entire region. Additional studies should be conducted to address the impacts and to possibly develop a regional solution to the salinity problem. Due to unknowns, it is considered too soon to include the RO/brine disposal system in the City's capital improvements program. However, salinity will continue to be a major issue for the City and for all dischargers to the San Joaquin River. The final approach to meeting the new salinity limits will need to be refined as the overall solution evolves.

## **6.0 WASTEWATER TREATMENT CAPITAL IMPROVEMENT PROGRAM**

The overall recommended wastewater treatment capital improvement program (CIP) includes the upgrade of facilities at Jennings Road plus improvements to the Sutter Avenue Primary Treatment plant and Primary Effluent Outfall as described in the Master Plan. The implementation plan includes proposed staging of the project through year 2030.

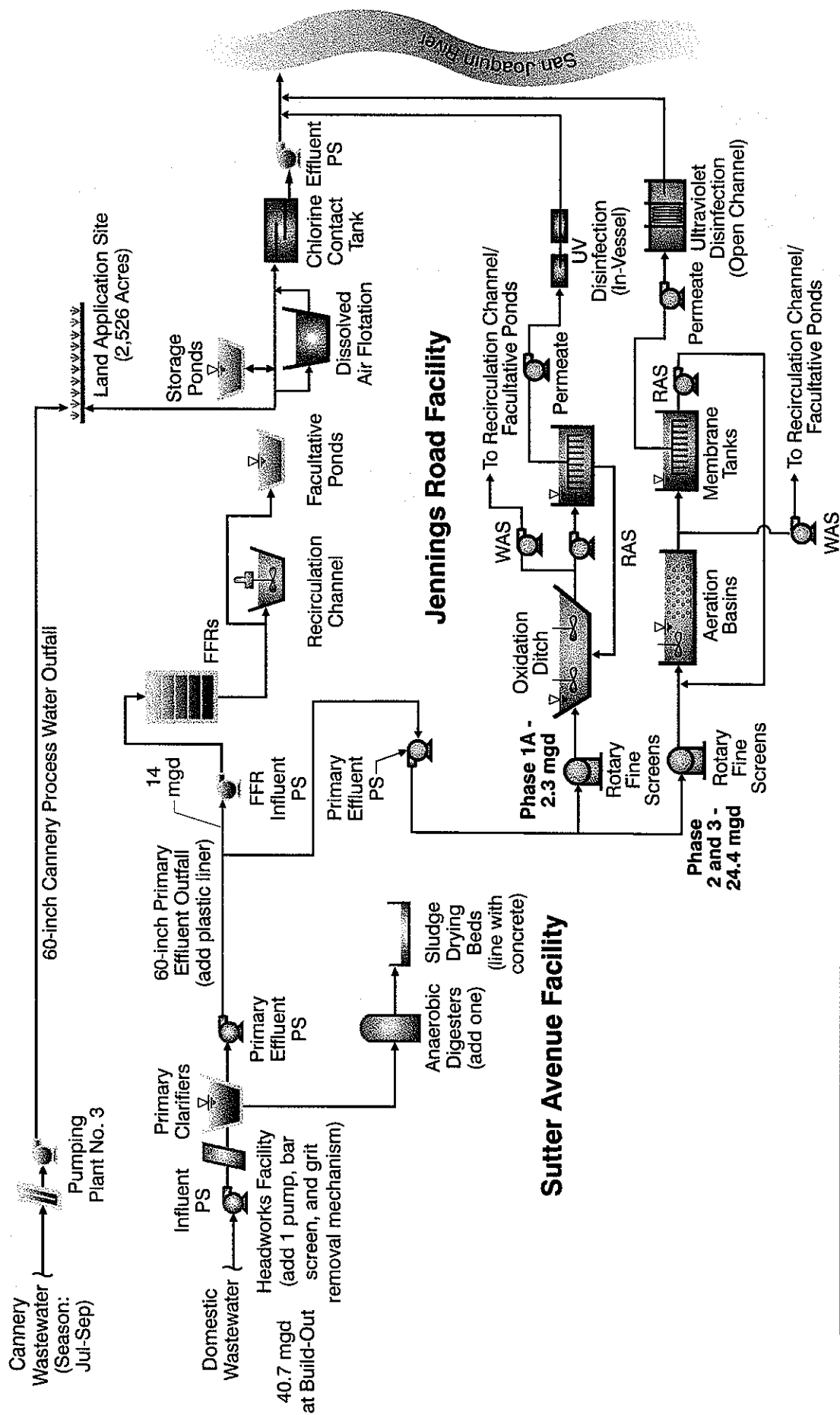
### **6.1 Recommended Project**

The recommended wastewater treatment CIP consists of the following components:

- Improvements to the Sutter Avenue Primary Treatment Plant to expand its hydraulic capacity, solids treatment capacity and to provide protection for a 100-year flood event.
- Relining the primary effluent outfall (from Sutter Avenue to Jennings Road) to increase its hydraulic capacity and to improve reliability.
- Expansion and upgrade of the Jennings Road Secondary Treatment Plant to increase domestic effluent disposal capacity and to comply with projected discharge requirements.
- Specific special planning studies required throughout the planning period. These studies include engineering system analysis, periodic Master Plan updates, and detailed scientific studies to verify appropriate loadings and land application methodologies associated with segregated cannery process flows.

The project components and estimated costs associated with the updated 2030 population projection are summarized in Table 5. All costs are based on June 2006 data to be consistent with those presented in the Master Plan and include allowances for contingencies, engineering, legal, and administrative expenses. Figure 5 is a schematic diagram for the recommended project.

<b>Table 5      Total Revised Wastewater Treatment Capital Costs</b> <b>Wastewater Treatment Master Plan Supplement</b> <b>Executive Summary</b> <b>City of Modesto, California</b>	
	<b>Costs in \$M<sup>(1)</sup></b>
<b><u>Sutter Avenue Primary Treatment Plant</u></b>	
Influent Flume Hydraulic Improvements	1.5
Bar Screen	0.6
Influent Pump	1.1
Grit Removal Unit	0.3
Primary Effluent Pump Station	9.3
Anaerobic Digester	4.8
Flood Control Improvements	14.0
Stormwater Pump Station	2.0
Sludge Dewatering	<u>7.6</u>
Subtotal Sutter Avenue Primary Plant	41.2
<b><u>Primary Effluent Pipeline</u></b>	
Lining of Existing Pipeline	23.2
<b><u>Jennings Road Secondary Treatment Plant</u></b>	
<b><u>Dissolved Air Flotation Project</u></b>	8.0
<b><u>BNR/Tertiary Improvements</u></b>	
Phase 1A Improvements	20.6
Phase 2 and 3 Improvements	
PE Pump Station	6.9
Fine Screens	5.3
Aeration Basins	30.4
Blower Building	12.3
RAS/WAS pump station	6.7
Membrane Tanks	63.7
UV Disinfection	15.1
Effluent Pipeline from Tertiary Plant to Exist. Outfall	10.5
New WAS inlet	0.2
Standby power	2.7
Reverse Osmosis System (if required)	0 <sup>(2)</sup>
Brine Disposal (if required)	0 <sup>(2)</sup>
Operations Center	<u>3.5</u>
Subtotal BNR/Tertiary Improvements	177.9
<b><u>Improvements to Existing Facilities</u></b>	
Conversion from Chlorine Gas to Hypochlorite	1.4
Effluent Pump Station Improvements	3.0
Outfall Improvements	4.0
Flood Control Improvements	0.2
Fixed Film Reactor Improvements and Odor Control	<u>7.5</u>
Subtotal Improvements to Existing Facilities	16.1
Subtotal Jennings Road Secondary/Tertiary Plant	202.0
<b><u>Special Planning Studies</u></b>	
Total Project	<u>10.6</u>
	277.0
<b>Note:</b> (1) Conceptual level costs. Based on June 2006 dollars (ENRCCI = 8441). Includes allowances for contingencies, engineering, legal and administrative expenses. (2) These processes may be required to comply with the future salinity TMDL in either 2022 or 2026. Costs range from \$58 M to \$218 M depending on brine disposal system chosen (see Chapter 5). Costs are not included at this time pending further development of a salinity reduction program.	



**Figure 5**  
**RECOMMENDED PROJECT SCHEMATIC**  
**WASTEWATER TREATMENT MASTER PLAN SUPPLEMENT**  
**EXECUTIVE SUMMARY**  
**CITY OF MODESTO**

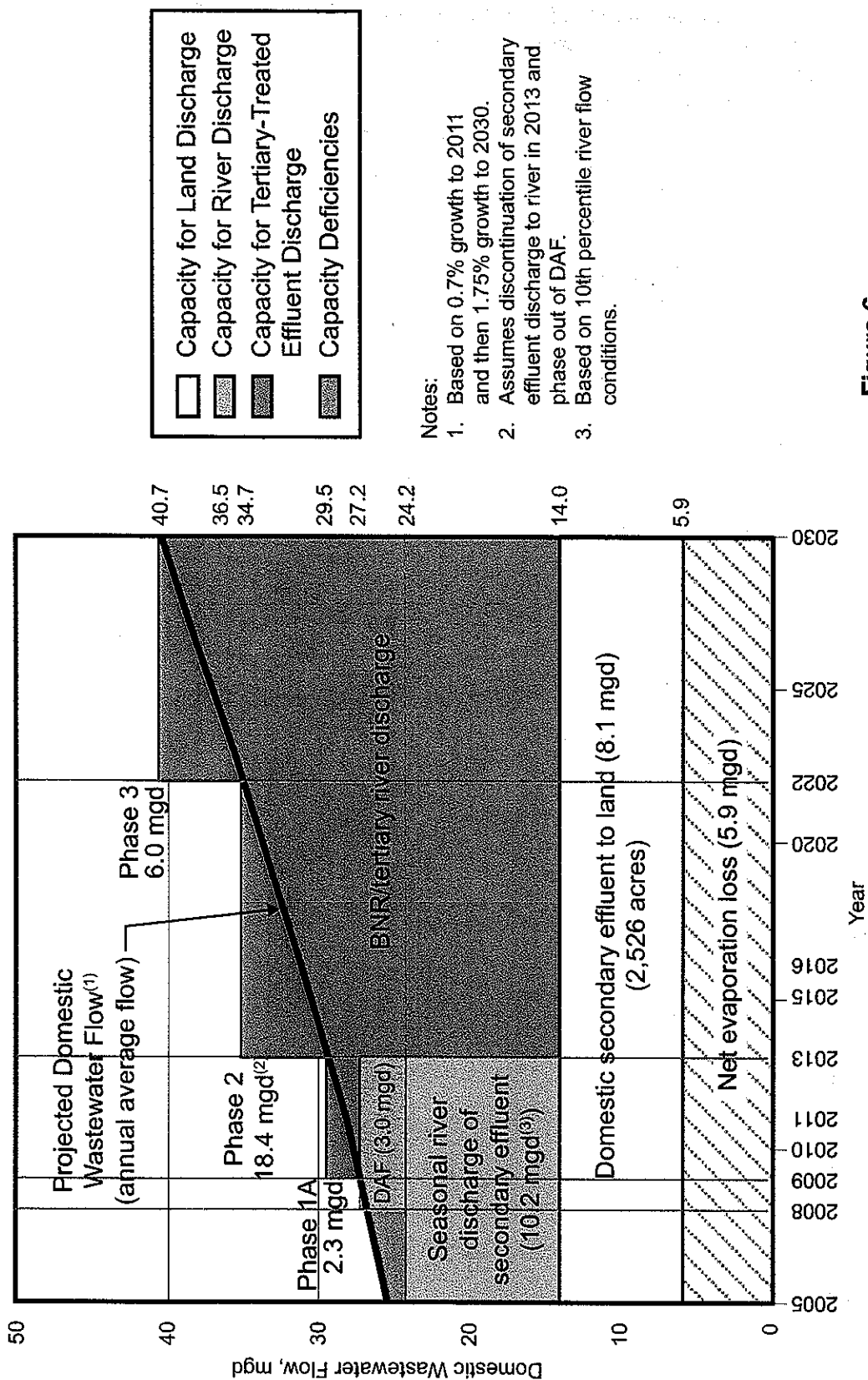
LEGEND	
	Existing Facilities
	Sutter Avenue Improvements
	Jennings Road Improvements
	Facilities to be Discontinued at Phase 2

## 6.2 PROJECT IMPLEMENTATION PLAN

The implementation plan was revised from the Master Plan to reflect the new waste discharge requirements and their compliance schedule, and to account for updated flow and loading projections.

Figure 6 shows the required tertiary treatment capacity needs and a phasing plan that would strictly follow the capacity needs for "just in time" phasing. Under this approach the tertiary phasing would be: 1A - 2.3 mgd (2010), Phase 2 - 18.4 mgd (2013), and Phase 3 - 6 mgd (2022). Phase 2A was added to spread out the costs between the Sutter Ave Facility and Jennings Road improvements. Table 6 summarizes the estimated project capital cost for each place.

Figure 7 is a near-term, implementation schedule for Phases 1A and 2. Figure 8 presents the estimated long-term schedule for all project phases.

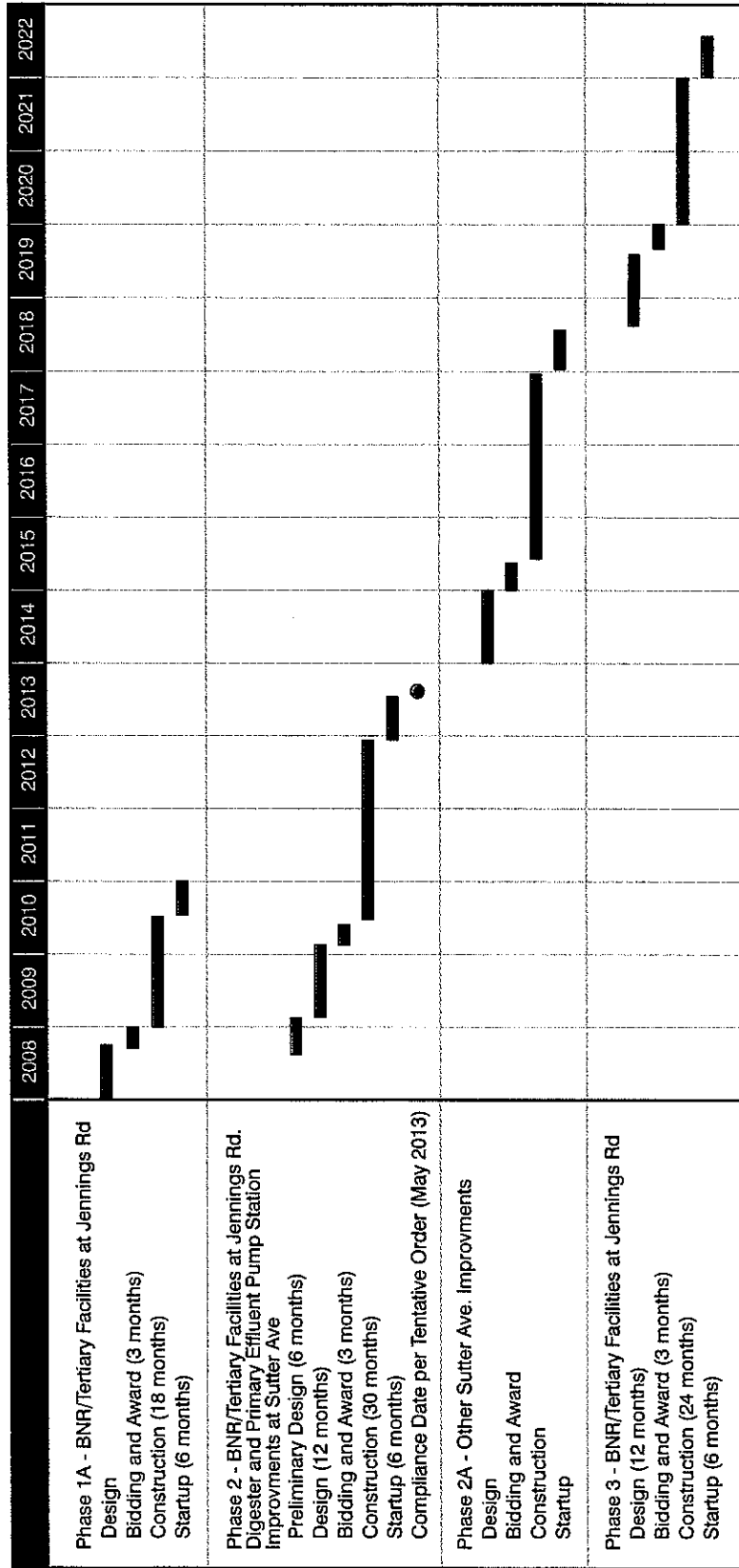


**Figure 6**  
**REQUIRED TERTIARY TREATMENT**  
**CAPACITY NEEDS AND PHASING PLAN**  
**WASTEWATER TREATMENT MASTER PLAN SUPPLEMENT**  
**EXECUTIVE SUMMARY**  
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<b>Table 6 Wastewater Treatment CIP Cost Phasing</b> <b>Wastewater Treatment Master Plan Supplement</b> <b>Executive Summary</b> <b>City of Modesto, California</b>						
Project Phases: Approximate Year of Implementation:	Conceptual Level Costs - \$M <sup>(1)</sup>					
	DAF 2008	Phase 1A 2010	Phase 2 2013	Phase 2A 2018	Phase 3 2022	Total Costs
<b><u>Sutter Avenue Primary Treatment Plant</u></b>						
Influent Flume Hydraulic Improvements	--	--	--	1.5	--	1.5
Bar Screen	--	--	--	0.6	--	0.6
Influent Pump	--	--	--	1.1	--	1.1
Grit Removal Unit	--	--	--	0.3	--	0.3
Primary Effluent Pump Station	--	--	9.3	--	--	9.3
Anaerobic Digester	--	--	4.8	--	--	4.8
Flood Control Improvements	--	--	--	14.0	--	14.0
Stormwater Pump Station	--	--	--	2.0	--	2.0
Sludge Dewatering	--	--	--	7.6	--	7.6
Subtotal Sutter Avenue Primary Plant	--	0.0	14.1	27.1	0.0	41.2
<b><u>Primary Effluent Pipeline</u></b>						
Lining of Existing Pipeline	--	23.2	--	--	--	23.2
<b><u>Jennings Road Secondary Treatment Plant</u></b>						
<b><u>Dissolved Air Flotation Project</u></b>	8.0	0.0	0.0	--	0.0	8.0
<b><u>BNR/Tertiary Improvements</u></b>						
Phase 1A Improvements	--	20.6	--	--	--	20.6
PE Pump Station	--	--	5.2	--	1.7	6.9
Fine Screens	--	--	4.0	--	1.3	5.3
Aeration Basins	--	--	22.9	--	7.5	30.4
Blower Building	--	--	9.3	--	3.0	12.3
ML/WAS pump station	--	--	5.0	--	1.7	6.7
Membrane Tanks	--	--	48.0	--	15.7	63.7
UV Disinfection	--	--	11.4	--	3.7	15.1
Effluent Pipeline from Tertiary Plant to Exist. Outfall--	--	--	10.5	--	0.0	10.5
New WAS inlet	--	--	0.2	--	--	0.2
Standby power	--	--	2.0	--	0.7	2.7
Reverse Osmosis System	--	--	0	0	0 <sup>(2)</sup>	--
Brine Disposal	--	--	0	0	0 <sup>(2)</sup>	--
Operations Center	--	--	3.5	--	0.0	3.5
Subtotal BNR/Tertiary Improvements	0.0	20.6	122.0	0	35.3	177.9

<b>Table 6      Wastewater Treatment CIP Cost Phasing (Continued)</b> <b>Wastewater Treatment Master Plan Supplement</b> <b>Executive Summary</b> <b>City of Modesto, California</b>						
<b>Project Phases:</b> <b>Approximate Year of Implementation:</b>	<b>Conceptual Level Costs - \$M<sup>(1)</sup></b>					
	<b>DAF</b> <b>2008</b>	<b>Phase 1A</b> <b>2009</b>	<b>Phase 2</b> <b>2013</b>	<b>Phase 2A</b> <b>2018</b>	<b>Phase 3</b> <b>2022</b>	<b>Total</b> <b>Costs</b>
<b><u>Improvements to Existing Facilities</u></b>						
Conversion from Chlorine Gas to Hypochlorite	--	1.4	--	--	0.0	1.4
Effluent Pump Station Improvements	--	--	--	3.0	0.0	3.0
Outfall Improvements	--	--	4.0	--	0.0	4.0
Flood Control Improvements	--	--	0.2	--	0.0	0.2
Fixed Film Reactor Improvements and Odor Control	--	--	7.5	0.0	0.0	7.5
Subtotal Improvements to Existing Facilities	0.0	1.4	11.7	3.0	0.0	16.1
Subtotal Jennings Road Secondary/Tert. Plant	8.0	22.0	133.7	3.0	35.3	202.0
<b><u>Special Planning Studies</u></b>						
Engineering System Analysis	0	0.6	0.8	1.1	1.1	3.6
Master Plan Updates	---	1.0	2.0	1.0	2.0	6.0
Land Application Studies	---	1.0	---	---	---	1.0
Subtotal Special Planning Studies	0	2.6	2.8	2.1	3.1	10.6
Total Project	8.0	47.8	150.6	32.2	38.4	277.0
<b>Note:</b> (1) Conceptual level costs. Based on June 2006 dollars (ENR CCI = 8441). Includes allowances for contingencies, engineering, legal and administrative expenses. (2) See note from Table 5.						





**Figure 8**  
**LONG TERM PROJECT SCHEDULE**  
 WASTEWATER TREATMENT MASTER PLAN SUPPLEMENT  
 EXECUTIVE SUMMARY  
 CITY OF MODESTO

